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Seven Fat Years

WE welcome the growing disposition amongst electrical men to think in millions; not in millions of pounds invested or earned, or in millions of units generated, for that is a quite old habit, but in millions of new consumers of electricity. Such thinking we regard as a reliable sign of the times, and we hope that it will promote energetic action everywhere.

The very timely speech delivered to the contractors last week by Mr. W. B. Woodhouse, of the Yorkshire Electric Power Co., should stimulate enthusiasm far beyond the circle represented by his audience. He gave us a definite objective when he expressed the belief that the next seven years would see 5,000,000 new consumers connected to the mains.

Those who are responsible for the policy of large electricity undertakings—especially what we call the "big power companies" and some of the larger company and municipal concerns—have to think expansively. The very nature of their task requires it; otherwise they become failures, and their lack of enterprise is a by-word. In such an area as that under Mr. Woodhouse's charge development policy and outlay are dictated by a daily close-up contact with immediate and prospective opportunities. Yet they have always to look well ahead. It might exercise a healthy influence amongst those who are running hundreds of other systems less important in point of size and demand if they were permitted to come more frequently into touch with the members of the "upper ten."

In practice we have divided electricity supply into company and municipal cubicles. But all must have as their objective the giving of a "cheap and abundant" supply of electricity wherever possible, with maximum efficiency, and for a reasonable return. The need for pursuing a policy of general development should induce co-operative action between all these different interests, and we repeat our wish that they had one united association. Some day it will come. Why not now?

Might it not go far to secure a more generous support of any new programme produced by E.D.A.? By the way, some of our readers are wondering when something striking is going to emerge as the outcome of last year's reorganisation and appointment. Is their impatience a matter for surprise after all the years spent discussing the matter?

For the present we return to Mr. Woodhouse's estimate of the development that lies ahead. We welcome his forecast because it should give the domestic appliances and lighting sections of the industry reason to expect that during the next seven years they are going to be called upon to provide the various products required for each of 700,000 newly connected premises per annum. The aggregate sale of these goods, if the wiring for *all* services of the household could be effected at once, as Mr. Woodhouse suggested, instead of piecemeal fashion, would be very substantial indeed when added to normal additions and replacements.

What is the Grid?

RAIN, once regarded as an enemy of insulation, nowadays performs an essential service in washing the insulators of overhead lines. The low rainfall in recent months, combined with fog, and sometimes frost, has caused conditions everywhere to approach those obtaining in areas where the atmosphere is normally dirty, and where special precautions have to be taken to maintain insulation values. Some information of this kind seems to have reached a daily paper, which immediately assumed without justification that the failure of supply in North London on January 24th was due to a breakdown of the grid, and amateurishly criticised its construction (which has gained our manufacturers so much credit abroad). The interruption was due, Lord Ashfield informs us, to the flash-over—under most abnormal weather conditions—of a switch at the Northmet Brimsdown power-station, and it was the grid which made possible an early resumption of supply. By "the grid" is generally understood the system of the Central Electricity Board.

but we have often heard new local (even low-voltage) lines referred to in the same way. This is an unfortunate tendency, as it is clearly desirable that the term "grid" should be restricted to the national bus-bars.

Size and Simplicity

THE recently completed first section of the "B" power house of the Barking generating station of the County of London Electric Supply Co., Ltd., represents several notable British engineering achievements. It contains the largest turbo-alternators in the country, the largest transformers in the world, and it has rendered the station, as a whole, the largest one in Europe on a single site. But it is size without frills. The plant and the layout are of the simplest possible character, nothing but proved and established engineering practice being followed. In this connection perhaps the most interesting point is the stoker firing for the boilers, for a measure of pulverised-fuel firing had been adopted in the older "A" power house. The Commissioners' returns show that a thermal efficiency (for kWh generated) of 23.55 per cent. has been achieved by the earlier installation, part of which has been in operation for nearly nine years. Even more striking figures may therefore be expected from the combined stations.

More Colour Needed

THE action of the Household Appliances Section of the London Chamber of Commerce in putting forward a selection of twelve colours for the guidance of manufacturers of domestic appliances is to be welcomed. The average kitchen could be made much more habitable by a greater use of colour, but so far electrical appliance manufacturers have not done a great deal in this direction. More has been done in the United States, but an attempt made here a few years ago to sell cookers decorated on colourful American lines did not seem to make much headway. One reason for our manufacturers' disinclination to go in for more colour is, no doubt, the ability of nickel and chromium plating and polished copper to stand up well to electrical demands and give appliances a bright and handsome finish. That is where electricity scores over gas, for gas fumes are not good for bright finishes. No doubt it is on this account that the principal blessing upon the new scheme has come from the producers of gas appliances. Be that as it may, it is no reason for the ignoring of colour by electrical manufacturers. White and mottled enamelled cookers, for instance, are handsome pieces of apparatus, but the use of coloured panels might render them even more attractive, with beneficial results upon sales.

One of the Least

AN undertaking that for nearly a quarter of a century has supplied a rural area containing not many more than 1,000 persons and for most of the time has earned a profit is a rarity. The Burford Electric Light & Power Co., of which Mr. N. F. Nalder is managing director, started in 1910 with a water turbine driving a 15-kW, 125-V d.c. dynamo. Within a few years the local gas undertaking "shut up shop." Small oil engines were added as the load grew to about 50 kW. The generating plant has now been superseded by a bulk supply from the Wessex Co., and at the same time the distribution system has been changed over to the standard 230-V a.c., with a view to tackling the domestic load in a manner that was not practicable at the lower voltage. Other small undertakings finding themselves in a similar position will be encouraged to learn that the reorganisation is not expected to worsen the company's prospects.

The Consumers' First Cost

NOBODY wishes to ignore the fact that electricity supply authorities have a most direct interest in the supply of apparatus and fittings in the domestic field. Their main responsibility is to see that their commodity is available, but they are equally under the obligation to see that assistance is at hand for the public to obtain the means for its utilisation. Who is going to say what is a reasonable price to pay for these means? Householders have come to regard hire and hire-purchase methods as essential. They have formed the habit—how or why matters little. Many people would not be domestic electrical consumers to-day were it not for the provision of such facilities. Those who can find the capital cheaply for financing this part of the work will help both the manufacturing and contracting sides of the industry, and will ease the way for the attraction of the five million new consumers. It is, therefore, most desirable for such co-operative trading relations to be established between all parties. Manufacturers and electricity suppliers can find ways for financing hire-purchase operations. Can the contractors do so? Or the wholesalers? Private finance organisations are prepared to assist, but what are the chances for the industry to establish its own united facilities?

An American Estimate

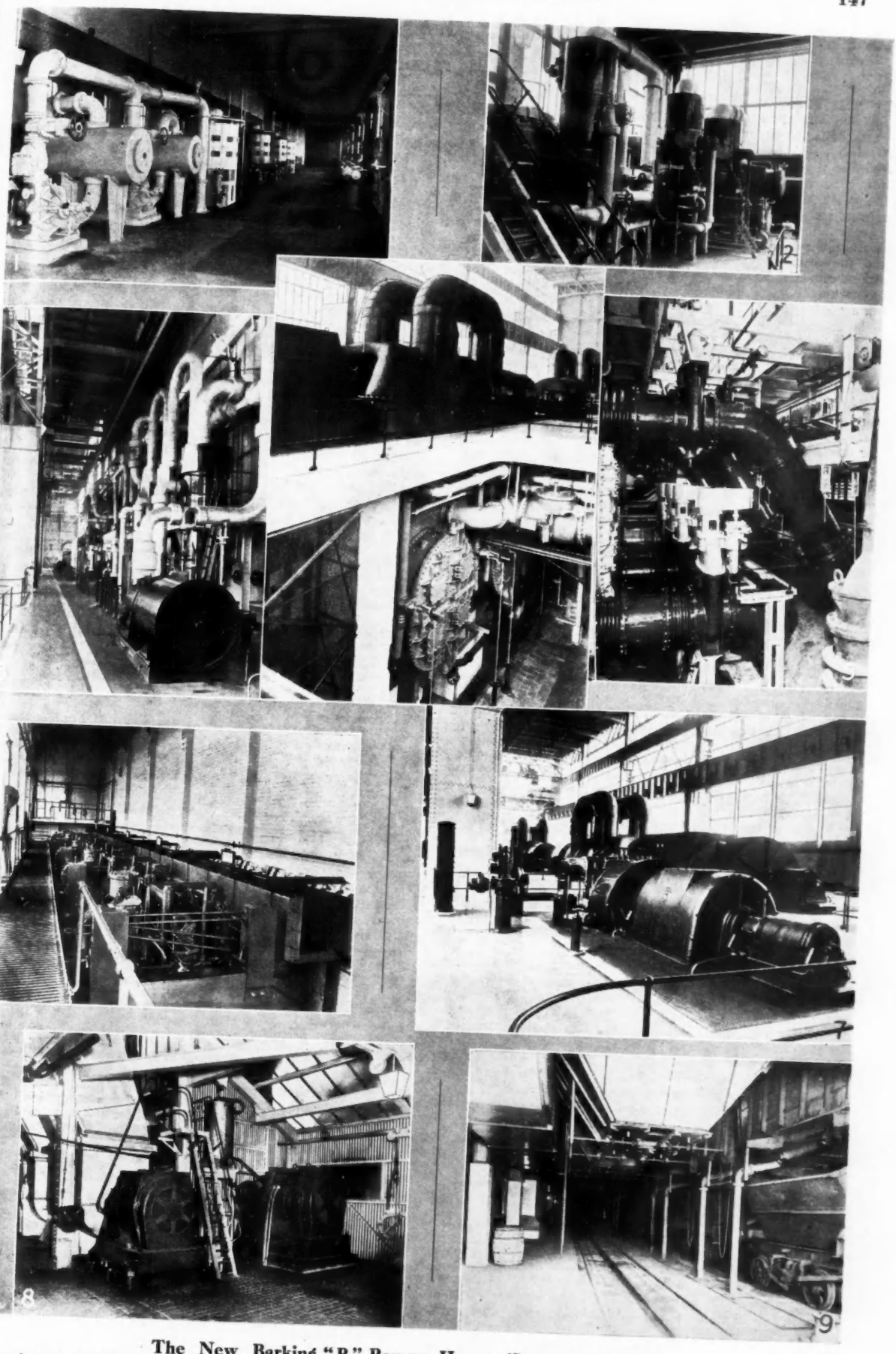
WE read that an American trade association estimates that with the present upward trend in home electrification the market for electrical appliances in the United States this year will be $5,000,000,000. That is an astounding figure; it seems so optimistic as to be altogether too extravagant. We will not hazard a guess regarding the possible market in this country, but, whatever it is, we hope that British factories will secure their fair share of it. They have not been lacking in providing facilities for production, and we hope that they will succeed in profitable distribution at such prices as will bring purchase or hire-purchase well within the capacity of the millions whom we are anxious to enrol as satisfied consumers of electricity.

Dead-man Control

THE death of the driver of a steam locomotive on the Tring-Euston line last Monday might have had more serious consequences but for prompt action by the injured fireman, who was able to shut off steam, thus enabling the guard to bring the train to a standstill by the hand-brakes. The possibility of the driver becoming incapacitated would justify the employment of a second man on the footplate, quite apart from the performance of normal duties. With an electric train, whether current be derived from an external source or from a Diesel set, safety of the passengers does not depend on the presence of mind of other officials (who might also be unable to act). The driver is immune from risks of the kind involved (the bursting of a smoke tube), and should his faculties fail for any reason the simple "dead-man" control would automatically cut off power, apply the brakes, and stop the train.

Steam Conditions

IN the view of many British turbine designers, the highest commercial efficiency is to be obtained with steam conditions of about 650 lb. per sq. in. and 850 deg. F., but the trend of practice in the U.S.A. is not so clear. The new Port Washington station now under construction is designed for 1,390 lb. and 840 deg., and the State Line extensions for 1,200 lb. and 825 deg., but Buzzard Point (the only new public supply steam station put into commission in 1933) has 600 lb. and 825 deg., and the reconstructed Connors Creek 710 lb. and 850 deg. It has been said that the use of the lower pressures is not due to any doubt as to the reliability of plant operating at the higher, but to the desire to avoid inter-stage reheating. This might imply that the sets are to be run at load factors of less than 60 per cent., as this appears to be the point at which the additional capital expenditure incurred by reheating is balanced by thermo-dynamic savings. If the results at Dunston come up to expectations, they should influence design in all countries, and stabilise the 650 lb. range for some time ahead. Comparisons with the Bradford 1,100-lb. installation will be awaited with interest.



The New Barking "B" Power House (See page 149)

1. Condenser circulating pumps in separate pump house, showing (on left) the receivers of the hydraulic equipment for clearing silt from main pumps. 2. Some of the evaporator plant. 3. Boiler feed pumps, and h.p. evaporator and i.p. feed heaters for one set. 4. One of the main sets complete with its condensing plant. 5. Inlet and outlet condenser circulating-water arrangement, showing electrically operated valves. 6. The top of some of the 33-kV switchgear. 7. General view of the turbine room; house set in foreground. 8. A pair of forced-draught fans. 9. A section of the ash basement.
(Photographs specially taken by THE ELECTRICAL REVIEW.)

Re-superheating. By Sydney D. Scorer

Its application to high-pressure steam turbines

THE present interest in re-superheating may be largely attributed to the increasing vogue for steam conditions of from 600 to 3,200 lb. per sq. in. at from 700 to 900 deg. F. At such pressures the large range of expansion from the high to the low pressure results in the steam becoming wetter than usual during its passage through the machine; the greater the efficiency of the latter the greater is the degree of wetness.

Once the condensation limit is reached, the water in the mixture tends to move at a lower velocity than the steam, and the resultant disturbance of the velocity diagram conditions causes the water to strike against the blade backs and to exert a retarding influence. At high blade speeds this striking action is of the nature of small hammer blows, so that in a short time the surface of the metal is eroded and ruptured.

By extracting the steam from the turbine at a point just before it becomes wet, re-superheating it to its initial or some intermediate temperature, and then returning it to the machine to continue its expansion these phenomena may be avoided, and the blading life and efficiency considerably increased. In addition, re-superheating has a beneficial effect on the efficiency of the turbine thermal cycle. More heat is available for doing work after the re-heating stage, the gain in efficiency in some instances being of the order of 7 per cent. This applies particularly to steam turbine sets where feed heating is accomplished by steam bled from the prime-mover, as economisers are then unnecessary and the heat for the re-superheating may be taken from the lower temperature flue gases on their way to the stack.

In the Low-pressure Stage

It is in the low-pressure section of a steam turbine, however, that the greatest inefficiency is to be found, and it is here that re-superheating shows up to best advantage. A large proportion of the gain arising from this practice is in the increased dryness of the steam in this section, resulting in improved stage efficiency. In practice the savings may be minimised somewhat when flue-gas re-heaters are used, owing to the unavoidable pressure drop in the piping, &c.

The general opinion appears to be that the increased cost of the installation does not justify the adoption of re-heating for pressures below about 550 lb. per sq. in., and in practice it is confined to high-pressure installations only. At the lower pressures it may be warranted for very large outputs. For very high pressures the theoretical case for re-superheating is much strengthened, even for two or more stages, but considerations of capital cost generally reduces the number of stages to one.

Again, the increase in efficiency due to re-superheating depends on the stage of the expansion at which the steam is withdrawn, as at a high pressure the gain will be less. The accompanying table showing the practice in nineteen representative moderate- and high-pressure power stations indicates some divergence in the re-heat pressures and temperatures for the same initial steam conditions.

For re-superheating the heat in the flue gases of the main boilers may be used; a separately fired re-heater is sometimes provided or the steam may be passed through a live-steam heater. The first two methods have the advantage that the steam may be raised in temperature to its original superheat, but the piping to and from the boilers greatly complicates and adds to the cost of the station; the higher the re-heating pressure the smaller will be the size and cost of the steam pipes. With live-steam superheaters only one pipe is required to convey the heating steam from the boilers to the re-heater situated in the engine-room, but the re-heat temperature will be less than that obtainable with flue gas re-superheating. A temperature gradient of at least 50 deg. F. between the heating and re-heated steam is necessary to provide the necessary heat flow, which limits the resultant re-superheat of the steam to about 500 to 550 deg. F., but this is offset by the reduced cost of the equipment.

Expansion Difficulties

If steam is withdrawn from some point in a turbine casing, re-heated to its initial temperature and returned to the same casing, there will be considerable temperature difference between the adjacent stages, with subsequent expansion difficulties. This has led, in general, to the adoption of multi-cylinder machines, the steam being withdrawn from the high-pressure cylinder exhaust and returned at the higher temperature to the low-pressure section. The low-pressure entry stages are then subjected to the same thermal stresses as the high-pressure end, and this necessitates the use of cast steel for at least the first few low-pressure stages.

Moreover, since the usual brass and similar materials cannot be utilised in this section for blading it is necessary to apply five per cent. nickel and other alloy steels. A further effect on the turbine is that an increase in the number of low-pressure stages may be advisable so that full advantage may be taken of the increased available heat drop, and in limiting cases a three or even four casing construction may be necessary.

In the State Line plant, at which the turbine stop-valve conditions are 650 lb. per sq. in. and 730 deg. F., steam is withdrawn and passed through a live-steam re-heater when the pressure falls to 110 lb. at 400 deg. F. The re-superheat temperature is 500 deg. F. The total power is divided between one high-pressure cylinder, giving 76,000 kW, and two double-flow low-pressure cylinders giving 66,000 kW each; a total of 208,000 kW. A live steam re-heater is also used in the Rouge River plant for the 100,000-kW set. In this the initial steam conditions are 1,200 lb. and 750 deg. F., but the pressure is allowed to fall to about 80 lb. before re-heating the steam to 550 deg. F.

The latest example of a re-heating installation in British practice is at the Dunston B station, and the conditions here are 600 lb. and 800 deg. F. at the turbine stop valve. Re-heating by flue-gas re-heaters is at about 120 lb., raising the steam temperature to its initial 800 deg. F. As an instance of Continental practice the Mannheim 4,800-kW set may be cited. The initial steam conditions are about 1,400 lb. per sq. in. with 800 deg. F. Steam is extracted at about 250 lb. and is reheated to about 640 deg. F.

TABLE OF INITIAL AND RE-SUPERHEATING PRESSURES.

Initial press. lb./sq. in.	Initial temp. deg. F.	Re-heat press. lb./sq. in.	Re-heat temp. deg. F.
450	600	65	500
550	725	155	725
600	800	120	800
650	730	110	500 (steam)
650	750	200	750
1,000	800	205	755
1,200	725	300	700
1,200	750	200	550
1,200	750	390	750
1,200	750	400	—
1,200	750	370	750
1,200	750	80	550 (steam)
1,200	700	350	700
1,250	750	400	750
1,400	800	260	640
1,500	915	200	660
1,500	890	185	545 (steam)
1,700	930	150	680
2,800	842	800	840

Owing to the volume of steam contained in the re-heater, piping, &c., somewhat extensive governing arrangements are necessary when the flue-gas type is used, as a sudden drop in the turbine load may result in the low-pressure section running away, with the danger of subsequent severe damage. With the steam re-heater re-heat temperatures are more easily regulated.

Colour in the Home

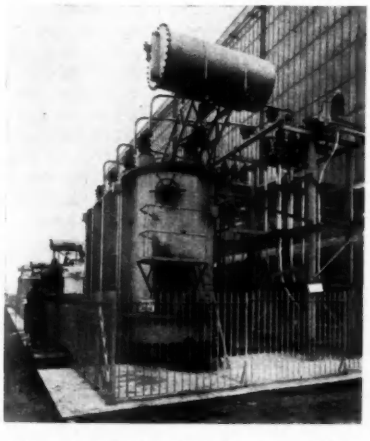
THE Household Appliances Association of the London Chamber of Commerce has launched a scheme for the simplification of colour schemes for domestic appliances and at the same time to encourage the greater use of colour in the home. At a luncheon of the Section last week, the chairman, Mr. G. E. W. Crowe, explained that a committee had been set up (which included representatives of the General Electric Co., Ltd., and Drake & Gorham) to study the colour question. As a result of its deliberations the committee had selected twelve colours from the range of standard colours drawn up by the British Colour Council. It was hoped that manufacturers and retailers of cookers, utensils, &c., would endeavour to popularise these to the mutual benefit of the trade and its customers.

Mr. Holbrook Jackson, chairman of the British Colour Council, gave an address on "Colour Fashions and the Home." He pointed out that there were now fashions in other things than women's clothes; motor manufacturers, for instance, had done a great deal with colour. The advance of colour in industry owed much to the developments in vitreous enamels and synthetic resins. Art and artists had played but a small part in the modern home and industry. Millions of people were anxious to have guidance in the choice of colours for their homes and this scheme would be of great assistance to them. The aim was not to standardise colour so much as to provide a code of reference.

Mr. Crowe said that he hoped that as many manufacturers of domestic appliances as possible would endeavour to produce samples of their products in the range of suggested colours for display at the forthcoming Ideal Home Exhibition.

THE BARKING "B" STATION

COMPLETION of the first half section of the "B" power house, with its two 75,000-kW generating sets, and at a cost of over £2,000,000, brings the total capacity of the Barking generating station of the County of London Electric Supply Co., Ltd., up to 390,000 kW, representing not only the largest station in this country, but the largest, on one site, in Europe. In 1931 the first power house ("A") of the scheme at Barking was fully equipped, its plant capacity totalling 240,000 kW. The two houses occupy forty acres. The new power house has been erected on the east side of the "A" power house, and it has a "T" lay-out, with the boiler house at right angles to the generating room. It might also be described as a glasshouse.



These Hackbridge transformers at Barking are claimed to be the largest in the world

The two power houses are quite separate units with common extremities, that is, they are fed from the same coal-handling system and the bus-bars are tied. The original jetty has been extended to 1,000 ft. long, and two electrically operated four-motor travelling and balanced luffing jib cranes, supplied by Sir Wm. Arrol & Co., Ltd., have been installed, making six in all. These will each remove coal from the 4,400-ton vessels at 200 tons per hour, delivering *via* the usual hopper and weighing equipment to the conveyor system, which will feed either the boiler-house bunkers direct or the store grounds. Each of two gravity bucket conveyors has a capacity of 125 tons per hour with a chain speed of 48 ft. per minute. The coal-handling plant was supplied by Messrs. Fraser & Chalmers Engineering Works, Ltd., and the conveyor system for the whole station will now deal with 1,400 tons per hour. The storage ground has been enlarged so as to accommodate about 60,000 tons.

A notable feature is that pulverised-fuel firing has not been adopted as was the case with a section of the "A" power house, and Mr. Vice, resident engineer, told us that they could not adopt pulverised-fuel firing any further until "this chimney question had been settled." He seemed to be fairly confident that the cost of steam generation would certainly not be lower for the new power house. Only one class of coal is used for both power houses, and it has a calorific value of about 1,150 B.th.u. per lb.

The boiler house (see page 157) measures 124 ft. by 224 ft. (centres of outside columns), and is served by self-trimming coal bunkers with a total capacity of 2,800 tons. There are eight boiler units, in two rows of four, each with a maximum output of 256,000 lb. per hour. Each unit embodies water-cooled furnace walls, chain-grate stokers, a gilled-tube economiser, a multi-loop self-heater, and a plate-type air heater, in addition to the usual induced- and forced-draught fans, cyclonic dust extraction equipment, and a water-jet dust-disposal system. The f.d. fans are situated at the back of the boilers on the firing floor level, and the i.d. fans are outside the building at the base of the chimney.

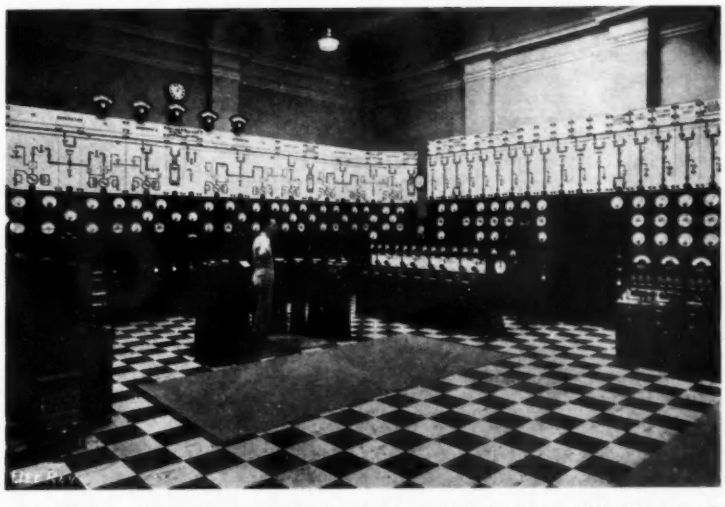
The "A" power house has twenty-six boilers, some of which burn pulverised coal, with a total normal evaporation capacity of 1,350,000 lb. of steam per hour.

The total boiler heating surface is 53,452 sq. ft., the total heating surface of the air heater is 16,650 sq. ft., the effective grate area is 669 sq. ft., and the combustion chamber has a total volume of 13,400 cu. ft. The whole of the boiler plant was installed by Messrs. Babcock & Wilcox, Ltd., and each boiler unit has its own particular complement of switchgear and transformer. The boiler plant is designed for the following temperatures, at a continuous maximum rating of 256,000 lb. per hour—air leaving the air heater, 248 deg. F.; water entering the economiser, 340 deg. F.; water leaving the economiser, 435 deg. F.; gas at the air heater outlet, 298 deg. F., and steam, 840 deg. F. Four new chimneys serving the boiler house are each 250 ft. high, 30 ft. in diameter at the base and 23 ft. in diameter at the top.

The turbine house has a span of 69 ft. and is 286 ft. long (column centres). It is spanned by a 175-ton and a 30-ton cranes, equipped with four (two-speed hoist) and three (single-speed hoist) motors, respectively.

The Generating Plant

The two 75,000-kW (maximum continuous rating) turbo-alternators, the largest in service in Great Britain, are of the three-cylinder impulse type and run at 1,500 r.p.m. The turbines are designed for a steam inlet pressure of 615 lb. per sq. in. Each main turbine is normally bled at three points for feed heating, but there is a fourth stage heater for use in conjunction with the evaporator if required. The high-pressure, evaporator and intermediate-pressure heaters are situated on the turbine room operating floor, and the low-



The Barking control room, which has been extended to deal with the output of the new station

pressure equipment is near the turbine foundation block. The two evaporators for each set are on the intermediate floor in the condenser basement. As against the crosswise arrangement of the turbines in the older power house, those in the new section are arranged longitudinally in the turbine room. There is also a 3,500-kW house set (maximum continuous rating). This is a single-cylinder set of the impulse type, and it runs at 3,000 r.p.m. The turbine plant was supplied by British Thomson-Houston Co., Ltd.

Each main turbine serves twin condensers with a total cooling surface of 68,000 sq. ft. There are two passes in the water space, and for a maximum rating each twin set requires 50,800 gallons of water per minute. The water velocity is 4.64 ft. per second, and the frictional loss of head 6.16 ft. For the house set there is a single condenser with 5,000 sq. ft. of cooling surface and three water passes. The maximum rate of water circulation is 3,800 gallons per minute. There are four circulating water pumps of the vertical double suction centrifugal type, each running at 367 r.p.m. The normal quantity of circulating water for which each pump is designed is 47,000 gallons per minute, and the normal head, allowing for pipe and condenser friction and for siphonic action, is 41 ft.

The condenser circulating-water system is a particularly neat layout, and the inlet and outlet pipes are equipped with expansion joints and electrically operated valves. The condensing plant was supplied by Messrs. Hick, Hargreaves & Co., Ltd., the circulating water pumps by Messrs. W. H. Allen, Sons & Co., Ltd., and the circulating-water screens by Messrs. F. W. Brackett & Co., Ltd. On the turbine-room operating floor are the six boiler feed pumps—three steam-turbine driven ones made by Messrs. G. & J. Weir, Ltd., and three motor-driven units produced by Messrs. Mather & Platt, Ltd. Each has a capacity of 410,000 lb. per hour against a discharge head of 850 lb. per sq. in. The steam pumps are purely for stand-by.

Large Transformers

The generating pressure is 12,500 V., and between the alternators and the switchgear are two 93,750-kVA transformers installed by the Hackbridge Electric Construction Co., Ltd. These transformers are claimed to be the largest in the world, each containing 43 miles of copper windings and weighing 120 tons. Because there was no bridge strong enough for them they had to be transported across the river on special ferries. They are connected star on the high-voltage side and mesh on the low-voltage side. Each constitutes a three-phase bank, and has oil-immersed forced oil circulation with a separate cooler and water cooling. They are provided with taps for off-load operation to cover a maximum voltage variation of ± 5 per cent. in 2½ per cent. steps. For the station there are 7,500-kVA transformers for 33 to 3 kV reduction. They are star-connected on both sides and oil-immersed self-cooled. The main transformers serve 33-kV duplicate-bus-bar metal-clad switchgear supplied by Messrs. A. Reyrolle & Co., Ltd. The bus-bars have a capacity of 2,000 A, and the switch rupturing capacity is 1.5 million kVA.

Diagrammatic Transmission Survey

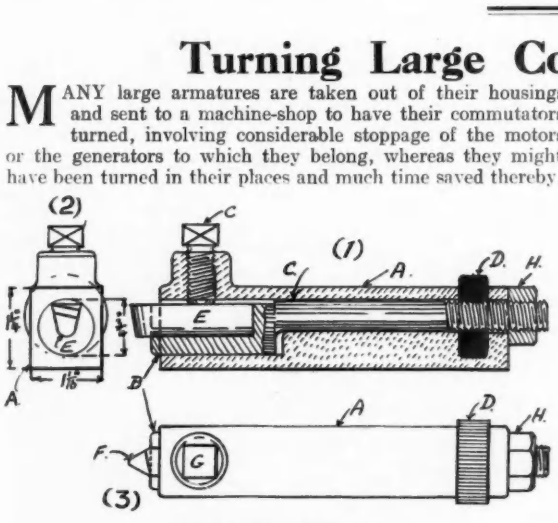
The existing control room at Barking has been greatly enlarged, and occupying the whole of one of its walls is a chart depicting diagrammatically the feeding arrangements on the e.h.p. system throughout the 3,000 sq. miles of territory served by the station.

Among the contractors for the equipment, other than those previously mentioned, are: Excavation, switchhouse and office foundations, John Gill (Contractors), Ltd.; switchhouse and office buildings, Holloway Bros., Ltd.; station foundations and buildings, Concrete Piling, Ltd.; pump house and jetty, Peter Lind & Co., Ltd.; chimneys, Custodis (1922), Ltd.; switchhouse steelwork, Sanders & Forster, Ltd.; engine room and boiler house steelwork, Babcock & Wilcox, Ltd.; turbine house cranes, Sir William Arrol & Co., Ltd.; condenser tubes, Hudson & Wright, Ltd.; circulating water pipes, Stanton Ironworks Co., Ltd.; gravity bucket conveyors, Robert Dempster & Sons, Ltd.; piping equipment and auxiliary plant, Stewart & Lloyds, Ltd.; main and auxiliary cables and accessories, Enfield Cable Works, Ltd.; power station lighting, Woodford Showrooms (County Company); CO_2 fire fighting equipment, Walter Kidde & Co., Ltd.; auxiliary switchgear, Metropolitan-Vickers Electrical Co., Ltd.; and reactors, English Electric Co., Ltd.

In 1933 about 500,000 tons of coal were consumed at Barking, and the output for that year was 778 million kWh. Mr. W. J. H. Wood, engineer-in-chief of the company, has been responsible, with the consulting engineers, Messrs. Merz & McLellan, for the extensions at Barking.

Turning Large Commutators in Place

MANY large armatures are taken out of their housings and sent to a machine-shop to have their commutators turned, involving considerable stoppage of the motors or the generators to which they belong, whereas they might have been turned in their places and much time saved thereby.



The tool-bar described

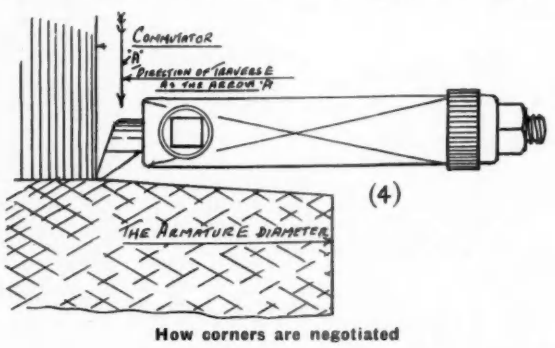
Quite a number of concerns possessing electrical installations, familiar from experience with the considerable cost resulting from sending their armatures to the machine-shop, call on an outside firm to turn their commutators in their places. Even this method generally involves far greater cost than is necessary, because, due to unfamiliarity with up-to-date methods, a much more pretentious job is (shall we say) created than such a simple task warrants.

The usual means are to send along a turner and a couple of helpers. These bring cumbersome staging on which they fix, with bolts and plates, a *compound* rest to carry the tool-bar for the turning operation, whereas commutators may be turned, dependably and quickly, in quite a simple way by the owners' maintenance man.

The following is the method advocated. The commutator end of the armature winding is well covered with strong brown paper, or light sheeting, well shellacked on and all the brushes taken off the brush ring. To one of the brush-holder bases a suitable cast-iron base is attached, using the brush-holder bolt holes by which to fix the cast-iron bracket to the brush-ring. This bracket need not be large, for the reason that a compound rest is not needed when the tool-bar illustrated herewith is used. A slide rest for the traverse is all that is necessary, the cut being fed in by the means provided in the tool bar.

A is the bar, a casting of semi-steel; B is the cutter holder with an extension C and a knurled nut D. E is the cutter, tipped at F with carbolog or No. 40 stellite. G is a set screw which simultaneously grips the cutter E and the cutter holder B, and H is a lock-nut.

Fig. 4 shows how corners are negotiated, with side tools. The new bar with the bracket referred to is fixed to the brush ring and the bar, plated in the usual way to the single slide rest, with the lock-nut H slack. The tool-holder is fed in with fingers and thumb; then, with the cut set, the lock-nut H is tightened up and the cut taken over the commutator face, other cuts following until the commutator is trued up. It will be found that, when cutters tipped with carbolog, or with the newest brand of stellite No. 40, are employed a much higher



How corners are negotiated

turning speed than common may be used; and, moreover, as the hard "tips" clear away the mica insulation very little buffing will be necessary.

"MAINTENANCE MAN."

Some Driving Forces in the Industry : S. Wolf & Co., Ltd.

Left to right: Mr. S. Wolfe, founder and governing director; Mr. G. Wolfe, export sales; Mr. R. F. Hatto, sales manager; and Mr. H. Richards, technical director (*Photographia, Ltd.*).

Two-part Tariff Metering. By B. Sleath, A.I.E.E.

IT is essential that a two-part tariff should be simple and should reward the consumer for continued and extended use of electricity; the meter employed should show him plainly what is taking place. The two-part tariff prepayment meter offers an inducement to use electricity for heating and cooking, whereas the ordinary prepayment meter records only the electricity used for lighting. Where a two-part tariff prepayment meter has been installed, the consumption of electricity has usually been from 20 per cent. to 50 per cent. more than when an ordinary prepayment meter has been in use.

As the fixed charges have to be collected quarterly by the rendering of accounts, it is in many cases difficult to collect these amounts, and rather than pay the bill some consumers will allow themselves to be cut off, whereas with the inclusion of these fixed charges in a prepayment meter the consumer hardly notices the increase. This class of meter is also useful where a hire-purchase wiring scheme is in vogue, and many consumers are induced to have their houses wired and pay in this way. These meters will collect rateable value, floor area, hire of apparatus, or any other charges the supply authority wants to add on, in addition to the low-priced kWh charge.

Such meters are divided into three classes, as follows: (1) Where the fixed charges are taken out of a definite consumption at a high price per kWh, after which the mechanism changes over to a different ratio of gearing, all remaining units used being charged at a lower rate. This type is applicable to both a.c. and d.c., but it has the drawback of depending on the amount of energy used to obtain the full fixed charge; it is impossible to say definitely how much per quarter this meter will bring in, and if little energy is used, the consumers think they are paying high rates, although amounts received for the fixed charges are very low. (2) The Ferraris disc type, which has proved fairly satisfactory, as the Ferraris motor is running all the time and can be set to collect a certain amount per week so that the consumer if he wants to use electricity for anything at all has to pay these charges. The drawback here, is that every time a different fixed charge is made the Ferraris motor has to be checked, which involves the expenditure of time and care. (3) The synchronous motor type of meter, in addition to the meter element and summation prepayment gear, has a synchronous motor in place of the Ferraris disc. The insertion of a coin causes the switch to be closed, which is reopened by the combined action of the meter element, and the motor operating through the summation gear. The motor is running at a constant speed whether energy is being used or not. It thus ensures the payment of fixed charges even at a time when clocks or wireless may be the only load, which is too small to work the meter.

Mr. Bernard Sleath

These instruments can be arranged to collect arrears (if wanted) resulting from absence on holidays. This practice may be unpopular, and I would suggest that the year should be divided into fifty, thus collecting in fifty weeks what should be collected in fifty-two. The consumer will hardly notice the small difference, and can be away for two weeks without getting into arrears.

If an "arrears" arrangement is considered necessary this should be clearly pointed out to the consumer, as should the house be left empty the arrears will mount up, and on his return he must put into the meter the appropriate amount of money before the switch can be brought in again. In any case, as the prepayment meter is put in to collect moneys in advance, this class of consumer would seldom be away for more than two weeks together; if an "arrears" system is required, it should be limited to only a small run back, say four or six coins.

The Recovery of Arrears

It is quite easy to work out if a consumer has been away for a longer period than that arranged for, or has deliberately refrained from using electricity. These cases are rare, and an account would have to be rendered to collect these charges. The meter arranged with a long run back or arrears arrangement has the disadvantage that certain classes of people will always run into as much debt as possible, and when it comes to the time when a large deficiency has to be met, they are unable to pay. This means either cutting them off or putting up the price with the hope of getting it back in the future, but this badly upsets the clerical side of the undertaking.

The chief thing with the adoption of this class of meter is to persuade the consumer that he has to pay a fixed charge per week, whether electricity is used or not, but that the price of electricity is very low. He begins to look upon this low price as the price he is paying, and is thus encouraged to use extra appliances.

The two-part seasonal prepayment meter is exactly similar to the synchronous motor type, but enables different rates per kWh to be charged in winter and summer. The change is effected from outside the meter by the collector, who brings a different gear ratio into operation between meter counter and prepayment gear. The two-part minimum prepayment meter is also similar, except that the synchronous motor collects, in addition to the fixed charges, coins to cover a minimum number of kWh per annum, *i.e.*, an extra fixed amount. The meter element re-opens the switch only after the minimum consumption has been attained.

In all the synchronous motor types the motor is running at a constant speed, and the weekly charges are arranged by inserting price compounds for the amount to be collected, which can be varied from 1s. 8d. to £2 per week.

The New Electricity (Supply) Bill

The Electricity (Supply) Bill introduced by Mr. Thorp and backed by Sir George Hume and other members is down for its second reading in the House of Commons to-day (Friday). The Bill gives extended powers to electricity supply undertakings in the matter of breaking up roads, the cutting-off of the supply of consumers in arrears, and the entry of buildings for the purposes of inspection. Many other provisions are contained in the Bill, which although a private member's measure has enlisted a great deal of support and may have a better fate than the majority of private members' Bills.

Water-level Indicators. By Vernon Walker, A.M.I.E.E.

Conditions obtaining with modern high-pressure boilers

THE present trend of design towards smaller water storage space, and the employment of water-wall systems, together with high boiler ratings, has accentuated the difficulties caused by the "swelling and shrinkage" that occurs on rapid changes of load owing to the entrained steam bubbles in the boiler water, which form an appreciable proportion of the water-steam mixture at high ratings.

As only some sixteen to twenty per cent. of the total water is within the drum of a modern boiler at normal water level,

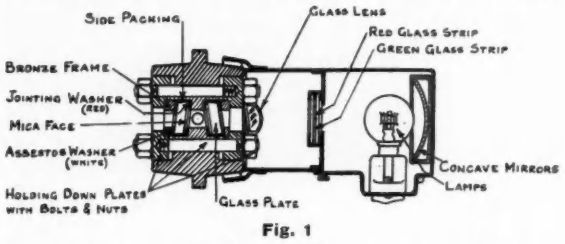


Fig. 1

the drum levels are seriously affected by changes in the steaming rate. Again, the operating staff of a modern boiler house often has considerable difficulty in ascertaining from the firing floor the correct reading of the water-level indicators on the drums, which are in many instances at a considerable height above the floor level. Intervening galleries, stanchions, feed pipes, &c., further obstruct the view.

A number of designs of distant indicators have been placed on the market. In one (fig. 1) the application of a direct optical principle is used to obtain a clear distinction between steam and water in the sight glass of a transparent water level indicator. A black japanned box, in which mirrors and lamps are housed, is attached to the boiler side of the indicator. Parallel strips of red and green glass are placed between the lamp and the indicator, and close to the body of the gauge a glass lens is fitted. Beams of light are projected through the strips and strike the face of the glass plate at different angles, each being refracted.

When the space between the glass is occupied by steam the refractive index is such that the green beam of light is bent and strikes the inside of the body of the indicator, whereas the red beam is so bent that it emerges from the indicator into the line of sight of the observer. If the space is occupied by water the red beam of light strikes the inside of the body of the indicator and is lost, whereas the green beam is bent into the line of sight of the observer.

The image of the indicator is projected by two mirrors to the firing floor, the upper mirror being attached either direct to the indicator, as in fig. 2, or to a point remote from the indicator. The image seen in the mirror on the firing floor is the actual water level as shown by the water gauge, there being no transmissions of the level by mechanical or other means. The internal face of the gauge glass is protected from erosion by mica.

Sources of Error

Gauge glass errors often occur due to the temperature difference between water in the drum and in the gauge glass. This can be seen by blowing down the gauge, when the level rises above the level indicated before blowing down. There is also an additional error due to the quantity of steam bubbles in the water in the drum. If no steam is being discharged up through the water in the drum to which the glass is connected, the error is due to temperature only. If, however, steam is being discharged up through the water the error will be due partly to temperature difference and partly to the volume of steam entrained in the water.

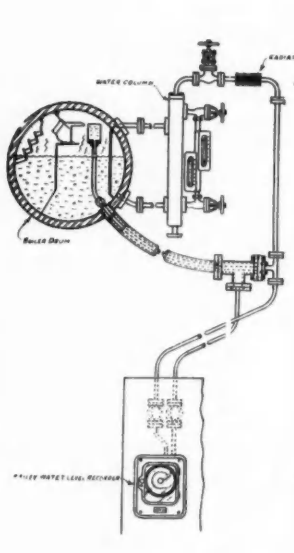


Fig. 3

The gauge glasses of high-pressure boilers in the United States are invariably connected to water columns, and the volume of water in the column and its connections is much larger than that in a gauge glass directly mounted on the drum, as in English practice, and the temperature error may be greater. With the gauge directly mounted the volume of water contained in the gauge and its connections is reduced to a small amount. Also, if the steam connection is left uninsulated the rate of condensation should be such as to effect a complete replacement of the water in the glass at frequent intervals; the temperature of the water will be raised to a temperature near to that in the drum, and any error due to temperature difference correspondingly reduced. The provision of a periscope housing to the gauge fittings maintains the temperature around the glass near to that of saturated steam temperature, and the error due to coolin is reduced.

It has been noticed sometimes that the direction of the w. has a marked effect on the gauge level, different levels bein indicated by gauges situated at the two ends of the dru according to the wind direction. Levels can be checked by fitting an insulated piece of copper bar vertically within the boiler; after a time a water line, probably due to electrolytic action, will be found on the copper strip. Alternatively, an insulated rod has been installed at a half-way position in the drum and connected to an electrical circuit that includes the water in the drum and the drum itself; at different loads the gauge readings were within ½ in. of the level shown by the electrical device, the water connection between drum and gauge being insulated and the steam connection left bare. Thermometer readings taken at four points on the water leg showed a maximum temperature adjacent to the gauge and a continuous fall in temperature below that point and a point adjacent to the boiler drum. This seems to indicate a positive flow through the water leg due to condensation, and that the error due to relatively cold water should be small.

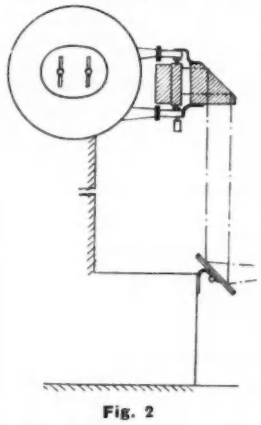


Fig. 2

Recording Instruments

Water-level recorders (fig. 3) are rapidly coming into use with high-pressure boilers to supplement the gauge glass; these help to determine the exact source of erratic or faulty operation due to feed water. They are either of the mercury sealed bell or float type. In the former a constant head connection with the steam connection of the water gauge or drum is applied under the mercury bell, and a variable head connection with the water space is applied over the bell. The bell rises and falls in accordance with the difference in pressure due to the constant head from the steam space and that due to the level of water.

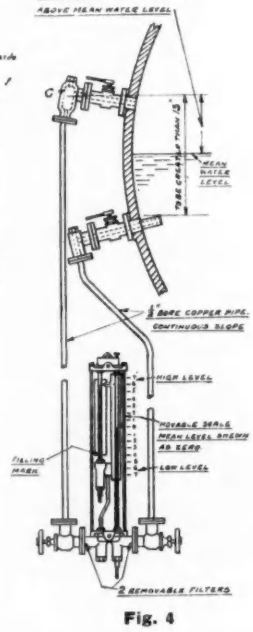

HEIGHT OF LIP IN 'C' TO BE 6½" ABOVE MEAN WATER LEVEL
C
MEAN WATER LEVEL
½" BORE COPPER PIPE CONTINUOUS SLOPE
HIGH LEVEL
MOVABLE SCALE MEAN LEVEL SHOWN AS ZERO
LOW LEVEL
FILLING MARK
2 REMOVABLE FILTERS

Fig. 4

The float type consists of a mercury manometer, with the h.p. leg located inside the l.p. leg; the motion of a steel float riding on the surface of the mercury in the h.p. leg is transmitted to the chart. By locating the cup inside the drum a reference is maintained and the recorder measures drum water level by measuring the water head difference between the reference point and the actual water level.

Temperature errors are eliminated by carrying the h.p. connection inside the l.p. connection to a point close to the recorder. The operator can ascertain at any time by looking at the chart whether the water level is rising or falling, even after it has gone out of sight in the gauge glass, and this gives him more confidence in time of trouble.

The remote indicator shown in fig. 4 consists of an inverted U tube assembly of glass and metal connected to the drum steam and water spaces. The lip C in the steam connection is 6½ in. above mean water level. Part of the left-hand leg of the tube is of large bore so that for working pressure changes there is no visible alteration in level in the sight glass. The right-hand leg is fitted with a movable scale marked in inches, the zero representing mean level. When the installation is charged with water the correct quantity of air is trapped in the gauge, and compressed under steaming conditions, the water level in the tubes rising. If the water level remains constant, the distance between the two levels does not alter with steam pressure but equals the distance between the datum line in the upper boiler connection and the water level, condensation maintaining the datum level. The reading given by the water level in the right-hand tube indicates the boiler level above or below the mean.

Gauge errors may be caused by deposits of mud in the water connections restricting the flow. The connections should not have pockets for the collection of condensation or water. Reducing orifices are not advisable in the connecting piping, and the joints should preferably be of metal rings. Soft packing extruded from a joint may cause serious errors. In many cases it would be advisable to increase the range over which the water level is visible by an extension or addition of the gauge glass so that the lowest possible level is indicated. This would enable the boiler to take variations in load without the water going out of sight in the indicator.

Power-factor Correction. By H. Neale

A graphic method of calculation.

THE power-factor correction problems dealt with in this article are of three types, *viz.*:—

(a) To find the resultant p.f. after adding to a factory load a synchronous or compensated motor of definite h.p. operating at a predetermined p.f.

(b) To find the required kVA capacity of a synchronous motor of definite horse-power (and the leading p.f. at which it will have to operate) to raise the p.f. of a factory load to a predetermined value.

(c) To find the kVA capacity of a synchronous condenser as (b).

Graphical solution remains the simplest, as well the least liable to error. Calculation, as well as being laborious, may

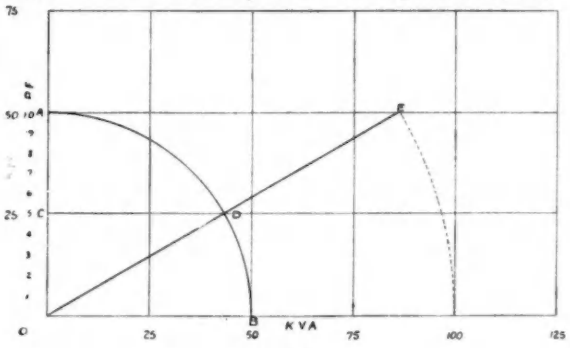


Fig. 1

incur arithmetical or other errors which are not immediately apparent. The customary construction is as shown in fig. 1, using metric graph paper. With centre O and radius OA the quadrant OAB is drawn. OA is marked off for power factors from 0 to unity. Assuming a vector to represent a certain kVA at 0.5 lagging p.f. is required, the point D, obtained by joining C to the quadrant, is joined to the origin O, OD being produced as required. AOD is the angle whose cosine is 0.5.

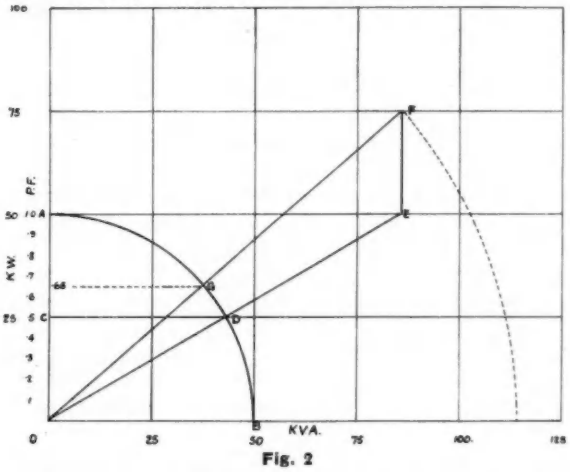


Fig. 2

The axes OA, OB, represent unity and zero lagging p.f. respectively, and can be marked off, to the same scale, to represent kW and (wattless) kVA respectively. The length of OE is the kVA corresponding to 50 kW at 0.5 p.f. lagging, i.e., 100 kVA. Since AE=sin AOE×OE, AE is therefore the wattless component.

To take an example of (a) above, assume that a synchronous motor of 25 kW input, designed to run at 1.0 p.f. is added to a 50-kW 0.5-p.f. load. Referring to fig. 2 the line OE is drawn, as for fig. 1. At E, the power component of 25 kW is added vertically (unity p.f.) increasing the total load to F (75 kW). The line OF gives the resultant kVA, the power factor being raised to 0.65, as shown by the projection of the point G on to the vertical axis.

Mr. Neale is a member of the staff of Lancashire Dynamo & Crypto, Ltd.

To illustrate case (b), assume that a synchronous motor of 25 kW input is, as before, required to correct the total load to 0.7 p.f. Referring to fig. 3, OE is drawn as before, also OJ at 0.7 p.f. lagging (the required resultant p.f.). As in the previous example the 25 kW power component is added vertically at E. F is then joined to OJ parallel to the horizontal axis, cutting OJ at H, and H joined to E. Since KH is the wattless component of the total load, HF is the wattless kVA added by the synchronous motor, and HE the synchronous motor kVA input. HE is measured with dividers and its value determined from the scale. The power factor of the synchronous motor is thus EF/HE=25/26.75=0.935 leading.

Case (c) is dealt with on similar lines to (b), the power component usually being of the order of 5 per cent. of the kVA rating of the condenser. It is necessary, therefore, to approximate the value of the kVA required, in the first case, in order to fix a probable value for the power component.

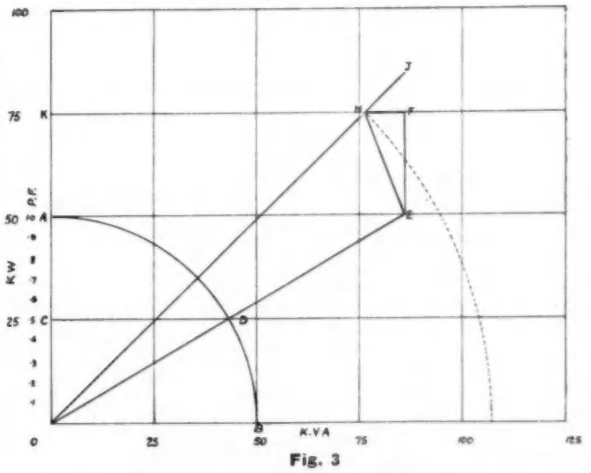


Fig. 3

Reverting to case (b), as the synchronous-motor p.f. is not known, its efficiency is also unknown, so that the kW input corresponding to the motor h.p. has to be approximated in the first case, and corrected when the power factor is established.

If the geometrical construction necessary is simplified or contracted, considerable saving in time will be effected in dealing with correction schemes in the estimating stage. To this

end I have constructed the graph shown in fig. 4. In order to obtain the maximum practicable accuracy, two quadrants were drawn, one at 10 cm. radius, the other at 20 cm. radius. In drawing the p.f. lines, the requisite points were marked off on both quadrants (those on the larger to double the smaller

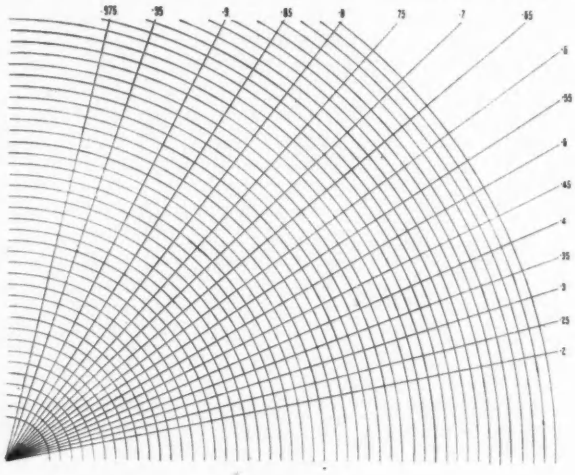


Fig. 4

scale), a double check thus being obtained on the positions of the lines.

This graph (which can be mounted on presspahn or three-ply wood) provides a " ready made " construction for the solution of problems (a), (b) and (c), with a greater degree of accuracy than obtains with individually made diagrams. There is no necessity to make a scale on the graph, as a suitable value per cm. can be assigned according to the order of magnitude of the vectors being dealt with. Alternatively, a series of graphs can be employed, marked with scale values of say, 1 cm.=5, 10, 20, 40 kW/kVA.

For example, to deal with either case (a) or (b) previously illustrated, a scale of 1 cm.=5 kW/kVA would be suitable. Taking (a), the point E in fig. 2 is readily fixed in the graph (fig. 4) where the 0.5 p.f. line intersects the 50 kW ordinate. Vertically above E, at the intersection of the 75 kW ordinate, the resultant p.f. is read off direct at practically 0.65, while the kVA, following the quadrant to the horizontal axis, is read off at 115. For case (b), having located point E, the synchronous-motor kVA is obtained by measuring with dividers the distance from " E " to the intersection of the 75 kW ordinate with the 0.7 p.f. line, and scaling off, the total kVA (obtained as before) being obviously 107.5 (nearly) on the horizontal scale.

Approximate p.f. corrections can be made at a glance to obtain the synchronous-motor operating power factor before proceeding to an accurate determination. The graph is thus of considerable service in saving time in both " trial and error " approximations, and in the solution itself. Further, it enables p.f. correction schemes to be considered at times or in situations when it is not convenient to produce drawing instruments or make elaborate calculations.

In determining the resultant power factor of a load comprising a number of motors of widely varying p.f.'s and outputs, the customary method of calculating the wattless kVA of each item with the use of sine and cosine tables or slide rule can be superseded by the use of the graph, from which the required wattless kVA can be read off direct, as abscissa, against the kW input ordinates at the power factor of each item.

Electrical Research in 1933

THE full effect of the financial crisis fell more heavily on the British Electrical and Allied Industries Research Association in 1933 than in the preceding year. But the Council, placing confidence in the future, decided at the beginning of the year to continue developing the work, notwithstanding some diminution of income in addition to a further reduction of £4,000 in the Government grant.

Thus the scale of expenditure was increased during 1933 with the result that now, instead of adding to reserves as in recent years, some inroad will have to be made on the reserve fund if the Association's income is not materially increased in the immediate future.

The thirteenth annual report states that the method of direct application for subscriptions to B.E.A.M.A. members has met with reasonable success, and by mutual agreement the B.E.A.M.A. Council has now been relieved of the obligation of collecting subscriptions for the Association under cover of a guarantee.

New Buildings

Much of E.R.A.'s strength is its ability to enlist the co-operation of other research organisations. But an important range of work remains which cannot be placed outside. Hitherto this work has been conducted at a number of centres, but it has now grown to such importance that the Council deemed it desirable to centralise the work in a new laboratory established for the purpose. Evidence is accumulating of the significance and value of the co-operative method of research to supply undertakers, in recognition of which a further number applied for membership.

During the year the High Commissioners in London for the Dominions and Colonies showed an active interest in the work of the Association, notably the Indian Government, and applications for membership were received from several local State Governments and Public Works Departments. Australian municipal electricity departments marked their appreciation of technical information supplied by the Association and bearing upon their local problems, by increasing their financial support.

Further advance has been made in knowledge of the fundamental properties of dielectrics and in the technique of measurement both at power and radio frequencies. Methods of studying electric strength have been improved and better knowledge obtained of the properties of dielectrics of the highest grade. The organisation by the staff of an adequately equipped emergency field force has enabled important information to be obtained at short notice on several problems connected with broadcasting interference phenomena, interference with communication circuits by earth faults on power systems, mercury arc rectifiers and other sources, and heating of cables in installations for the I.E.E. Wiring Regulations Committee.

Researches on concrete poles, pole foundations, earthing and the measuring of resistance of earth connections, and a.c. corrosion have continued. Further observations have been made on fittings for large incandescent lamps for different classes of service and methods proposed for remedying overheating. Researches have been commenced for the improvement of glass insulators, and steam investigations have been pursued.

Circuit-breaking Investigations

Further knowledge has been obtained of the breaking of an a.c. circuit, and of the pitfalls involved in the interpretation of oscillograms of circuit-breaker tests. Experiments have also been carried out in connection with E.R.A. circuit-breaking devices, pivots for integrating wattmeters, and surge phenomena. The work done on enamelled wires has greatly reduced the percentage of rejects of finished products in many factories.

Equipment for obtaining reliable records of voltage variation is relatively expensive and the amount of statistical work involved in analysis is immense, but during the year enough information has been accumulated to enable the investigators to form a clear idea as to the characteristics of the distribution curves found under commercial conditions. It would seem that the crude procedure of fixing maximum and minimum limits alone of voltage variation is not the procedure a statistician would advise on the evidence now available.

During the course of the investigation observation has shown that the advantages of a good supply are frequently lost by failure to prevent excessive voltage drop in consumers' wiring owing to the absence of adequate machinery for the purpose, and it is generally agreed that better regulation is needed.

Heating and Cooking Apparatus

It has been possible to issue a specification of methods recommended for testing the performance and life of boiling-plates, and it is thought that a British Standard Specification might be prepared.

The Association has co-operated in a small way with the Department of Scientific and Industrial Research and Medical Research Council in a comprehensive research on the physiological effects alleged by Sir Leonard Hill to be produced by so-called " dull electric fires." In adequately controlled experiments with a large number of subjects no evidence whatever was found of so-called " nose-opening " rays, but " nose-closing " was found to occur not only with a dull fire, but also with a bright fire, and could also be produced by heating the subject by convection or conduction, even the sun being found to be a " nose-closer."

The annual general meeting is to be held at the Savoy Hotel, London, on February 9th, and will be followed by the E.R.A. luncheon.

MEETINGS AND DISCUSSIONS

Current Topics and Opinions Expressed at the Institutions

The Post Office Research Organisation

A SURVEY of the activities of the Post Office in telecommunication research is made in the paper by Capt. B. S. Cohen which was read at the INSTITUTION OF ELECTRICAL ENGINEERS in London on February 1st. The new buildings at Dollis Hill, their equipment and organisation, are described and some particulars of the types of investigation carried out by the various research groups are included. Radio work is not dealt with and the paper is mainly confined to the principles and methods involved.

Capt. B. S. Cohen is in charge of the Dollis Hill Research Station

The number of persons employed and in training at Dollis Hill often exceeds 600 and the value of the station's plant is over £100,000, apart from consumable stores. The Research Department forecasts annually its general expenditure on staff, plant, and materials, special authority being obtained, as necessary, for expenditure exceeding a certain amount in any individual case. Schedules of running costs are maintained in each case so that the amount spent is constantly under review.

The number of investigations increased from 370 in 1927-28 to 511 in 1932-33. During the latter year, fourteen of the more important cases dealt with were of the type for which the revenue accruing could be adequately assessed, and these cases resulted in either increased annual revenues or savings to the Department, amounting to a sum more than double the total annual expenditure on research.

The organisation is divided into nine groups, each dealing with a different class of work and the ninth with technical training. An impulse generator to produce discharges of 250,000 V has been installed for the investigation of the effects of direct lightning discharges on subscribers' telephone plant. Field tests at fourteen different stations on the corrosion of galvanised-iron stay wires indicate that the life of the wire is in general a linear function of the thickness of the galvanising. It is possible to estimate the life of particular grades of wire in different areas; in some parts of South Lancashire the normal life of a stay wire is little more than two years.

The results of spectrographic analysis can be expressed quantitatively and as small a content as 0.00015 per cent. of copper in lead may be detected in this way. The method is providing data for the rapid assaying of cable sheathing alloys, and the G.P.O. has taken a leading part in the development of this method of analysis and introduced it to cable makers. The amount of testing done is indicated by the fact that over 500 tons of nickel-silver is used in the form of telephone relay springs. Telephone batteries installed in this country have a total capacity of 75,000 kWh and cost £450,000, the individual capacity of cells ranging from 8 to 10,000 Ah.

Use is made of the Dollis Hill station by many of the Service departments and colonial administrations, but no attempt is made to do work which might be better undertaken in some other research laboratory. Each investigation is normally made the subject of an illustrated report, the majority of which are circulated throughout the Department. In addition, a considerable number are sent to Service departments, Colonial and foreign administrations, and other interested bodies, which find the information in them of considerable value; much interesting material is obtained in return.

Power from Stored Water

AT an informal meeting of the INSTITUTION OF ELECTRICAL ENGINEERS on January 22nd, Mr. J. W. Shipley was in the chair when Mr. J. W. Meares, C.I.E., opened a discussion upon "Water Storage for Power." The subject has received a good deal of attention in the daily Press following a letter by Mr. Meares which appeared some months ago. He said he made no claim for originality, as the principle had been stated as far back as 1892 by Professor George Forbes—nor was he stating that it was always economically advantageous, but water power could be accumulated in many districts of Great Britain—of that there was no doubt whatever. Further, the system was extensively adopted on the Continent for reservoirs varying from quite small capacity to those of large area and of considerable head, and it was the question of its application to this country that he wanted to discuss.

He regarded the system of a series of scattered reservoirs on suitable sites as a better economic proposition than the Severn Barrage scheme, which he thought was too vast and too expensive to be of economic service, even though allowance were made for the much-needed road and rail access it would afford to South Wales. If in some way the salt water scheme could be combined with an ordinary water supply, there might be some justification for it. He favoured a reservoir in the Wye Valley which would be filled during the fortnightly spring tides and exhausted in the intervening period to generate electricity during the peak load hours of the national interlinking grid system.

Some of the hydraulic power accumulators on the Continent were described and their wide range of capacity and type of construction were mentioned. Mr. Meares said that in some cases, natural reservoirs were not available and entirely artificial containers were erected.

Can Marine Propulsion be Improved?

THE possibilities of applying the improvements which have been effected in modern land power plant to ship propelling machinery are discussed in a paper by Mr. W. T. Bottomley (of Messrs. Merz & McLellan) and Mr. E. W. Corbett, chief designer, and Mr. F. Piercey, assistant general manager, of the Wallsend Slipway & Engineering Co., Ltd., which was read before the NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS on January 26th.

The survey includes consideration of the effects of raising the initial steam pressure and temperature, of inter-stage reheating and more efficient progressive feed heating, and the use of electricity for driving all the auxiliaries. The resultant efficiencies are determined and the financial aspect of the various proposals examined for different classes of ship.

To enable the electricity proposed to be used for auxiliaries to be generated economically it is suggested that an auxiliary turbine should be fitted to run in parallel with the main l.p. turbine. When manœvring it would automatically take its steam from the main steam line *via* a pressure reducing valve, relay operated by the pressure in the auxiliary turbine receiver, the normal source of supply being sealed by a non-return valve which would automatically function as soon as the pressure at the inlet to the main l.p. turbine fell below a certain limit. Normally, the unit would be designed to do its full duty with an initial pressure equivalent to that when the main unit was developing full service power. It would also be capable of developing full duty with an initial pressure equivalent to that when the main unit was developing about 70 per cent. full

During the recent National Fête the Monaco harbour was brilliantly illuminated

power, and with a variation in vacuum depending upon the service the vessel is on. The automatic pressure-reducing valve would be set to function just below this lower initial pressure. By a partial nozzle control the unit would also function efficiently at partial loads.

In the heat balances it has been assumed that the stated electrical requirements represent about 85 per cent. of the full output of the machine, the full-load consumption per h.p. being slightly increased due to working at this partial load. On service this unit would exhaust directly into the main condenser. When manœuvring, the main steam supply to this auxiliary turbine would be passed through a de-superheater, thermostatically controlled, at the lower pressure.

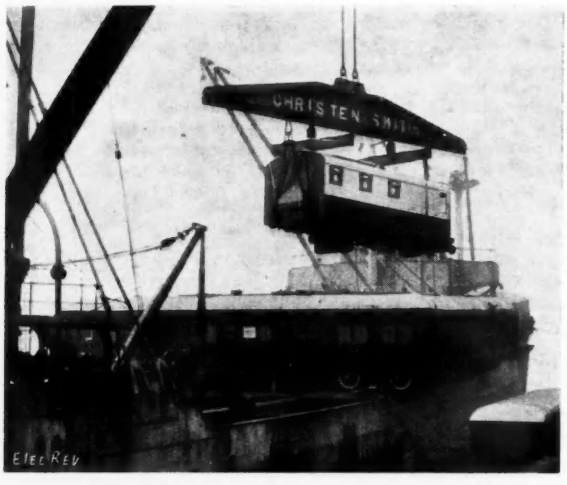
A standby unit, which would be used for harbour duty, would be arranged to work at the comparatively low initial steam pressure of about 120 to 150 lb. per sq. inch, the harbour boiler that it is proposed to fit being arranged to work at this pressure.

Under harbour duty conditions this unit would exhaust into a separate condenser. Under emergency conditions at sea it would take its steam from the main line *via* a relay-operated pressure-reducing valve, and, for the smaller-powered units, exhaust direct into the main condenser. For the larger-powered generators for the 20,000-h.p. liner the standby units, under emergency conditions at sea, would exhaust into their own condensers.

Automatic Combustion Control

INTRODUCING a paper on this subject at the INSTITUTION OF MECHANICAL ENGINEERS in London on January 26th, Mr. L. L. Robinson (joint author with Mr. J. L. Hodgson) remarked that his interest in the paper arose from the installation of three 150,000-lb. boilers at the Hackney electricity works. It was his desire to obtain a very steady steam line and very high efficiency, and to avoid the emission of smoke. Automatic control was decided upon as a means to that end and he had every reason to be entirely satisfied. Mr. Hodgson had been responsible for every detail, the plant having been designed to his own specification.

In the subsequent discussion Mr. W. Newton Booth said that the savings that could be made with automatic control, notwithstanding the extraordinary skill of many stokers, were remarkable. There was no reason why the Lancashire boiler should not be made as efficient as the watertube boiler, at any rate where moderate pressures were required. Moreover, the Lancashire boiler had very distinct advantages in other directions, such as capital cost and not being anything like so particular about the kind of water it was fed with. Although the development of automatic control had taken place principally in large power stations because of the size of the units, industrial engineers should investigate seriously whether similar advantages could not be obtained in smaller plants.



A complete Diesel-electric train for the San Paulo (Brazil) Railway Co. being shipped from the Armstrong-Whitworth works last week

Mr. F. L. Cater gave details of the savings being made with automatic combustion control in several large American stations. The figures varied from 1 to 11 per cent., but the latter large saving, in the case of the Lowellville station, was not claimed as due entirely to automatic control. Curves indicated how closely the predetermined steam pressure was maintained, the variation being not more than 2 lb. either way. Mr. C. Verity's opinion was that highly skilled supervision was required to ensure that such equipments worked satisfactorily. He doubted whether automatic control could quite do things in the human way. Boiler plant operation was not an exact science and in the event of any derangement of the equipment there would not be sufficient staff available to deal with the situation. Automatic combustion control development would have to be along much simpler lines. Mr. E. H. Smythe suggested that the authors had not fully answered the question which they themselves had put, *viz.*, "What saving would the use of automatic control effect?" According to the paper the cost of complete automatic control was 2½ to 3 per cent. of the capital cost, and considered in the light of a premium for efficiency it was not unduly high.

Other Systems

Mr. O'Brien said that the system described in the paper dated back to 1928 and was compared by the authors with the present day Kent and other systems. The Hagen system was in operation on some very large plants and had shown efficiencies of 85 per cent., compared with 78 per cent. with hand control. He deprecated any attempt to claim too high figures; at the present time he believed it would be found that the average gain would be in the region of 3 per cent. After all, 2 or 3 per cent. saving was enough, although 10 to 15 per cent. had been obtained with the Hagen system and in one case actually 28 per cent., although he did not claim that the automatic control was responsible in that case. Mr. Barker said that those who had advocated automatic control had merely shown how to do by very complicated systems what was already being done quite successfully without such systems at Clarence Dock, Dunston B, Blackburn Meadows, and the Princes Rock stations. Although automatic boiler control was undoubtedly a valuable development, one should regard it as an experiment at the moment which had yet to prove that it was something which justified its cost.

How Lightning Affects Overhead Lines

LIGHTNING was the subject discussed at the OVERHEAD LINES ASSOCIATION in London on Januuary 24th. Mr. J. F. Shipley divided his lecture into an account of the more popular views of the subject; the way in which lightning was generated, more particularly from the meteorological aspect; and finally a short account of troubles encountered as the result of its effects on overhead line work.

He emphasised the existence of an electric stress in the atmosphere as distinct from lightning, caused by the presence of a voltage gradient which always existed and could be measured. The range of a lightning flash might be from ½ to three miles and the voltage which caused it was roughly 1,000 millions. The "strike" lasted for perhaps twenty millionths of a second and the amount of energy dissipated in that short time might be of the order of 3,000 kWh. There were always 1,800 lightning strokes occurring at any one time on the earth, and if these were assessed at 100 per second, the total amount of energy being spent on the earth from electrical causes was roughly 9½ million million kWh.

The power installation of the Northern Nigerian tin mines had a capacity of 2,000 kW and was situated on a plateau 4,000 ft. high, which was absolutely bare of any cover and subject to heat storms every day for about six months of the year. An overhead line was carried over this plateau, and on the average one part or other of the system was struck by lightning once a day for six months of the year. July was the worst month for lightning storms. There was considerable difficulty in earthing because the whole area was volcanic. The neutral was insulated and that immediately brought down the number of stoppages.

The greatest trouble was the puncturing of insulators, through the head from the conductor to the top of the insulator pin. Different types were tried, and finally the pin was eliminated. A Continental type of insulator—now made in this country—was obtained which stood up very well and was adopted for a second line and, eventually, for the whole installation. Some 2,000 insulators of that type had been installed and only two had broken, one being damaged mechanically and the other by a flash-over.

In 1928 peroxide lightning arrestors had been installed at the two high points on the plateau and the result was a great improvement. Most types of lightning arrestors had their limitations. On the whole, however, they served a most useful purpose, and if they were installed and applied in a suitable manner very good results could be obtained.

Major T. Rich, president, said the view was spreading in European countries that the tendency towards lightning depended very largely on the geological formation. That theory was based on the idea that earth emanations tended to lower the resistance of the atmosphere and multiplied the possibilities of lightning. There was danger of lightning striking a transformer and shorting the high- and low-voltage windings, and

so bringing the high voltage into the houses. In certain parts of France there had been quite a number of fatalities from this cause and the Government had issued special regulations.

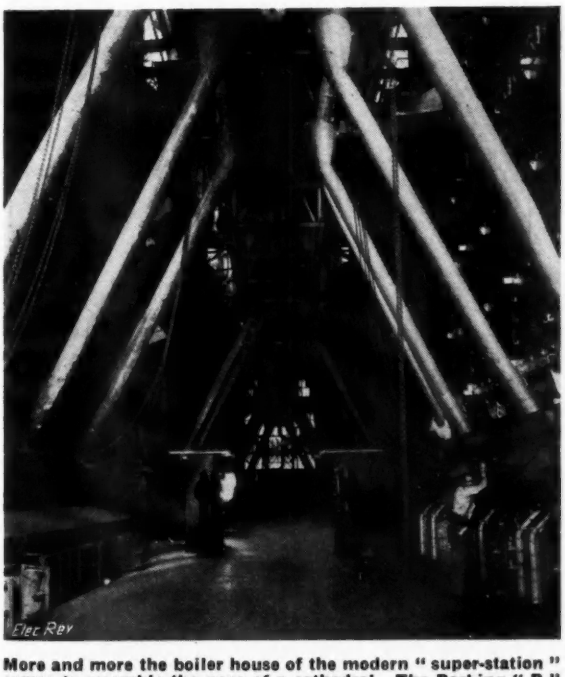
Mr. G. Collis said that the arrestor he was associated with was very simple. It was based on the resistance of an arc gap, which was fused silicon carbide soaked in a compound. It was not at all heavy and practically indestructible. It had a negative coefficient, and with it was combined a spark gap which was variable and could be set to whatever the line voltage was. In every case it had been found that this arrestor worked exceedingly well. Mr. W. A. Turnbull referred to occurrences in the Aylesbury area and said that although at the present time he had no lightning arrestors he was seriously considering their use, because of difficulties he had encountered.

Mr. W. Fennell said that peroxide pellet resistance was low until current passed through, and along the path through which the current had to pass there was a non-conducting section which reduced the current, whereas in Mr. Collis's method the reverse was the case. With an air gap in series Mr. Collis's proposal would tend to shut the line down because the voltage through the line, apart from the lightning, would follow through the arrestor. On the other hand, the peroxide pellet would gradually reduce the discharge current, and there would be no disturbance of any kind. If both of these arrestors worked satisfactorily it would appear that it did not matter what type of coefficient the resistance had.

Puncture-proof Insulators

Mr. G. H. Halton showed slides of insulators which it was claimed were puncture proof. He added that modern processes permitted of making the large thicknesses of porcelain used in these insulators completely vitreous and absolutely reliable. Mr. R. S. J. Swan said he had eight miles of three-phase copper line with spur lines, and fuses where lines left the main line. Every time there had been a thunderstorm anywhere within five miles of the main line, it had always been one of the spurs that had gone down. A new fuse was put in and everything was all right again, but although every insulator had been examined nothing wrong could be found with them. He had now put in some surge absorbers where the spur lines left the main line.

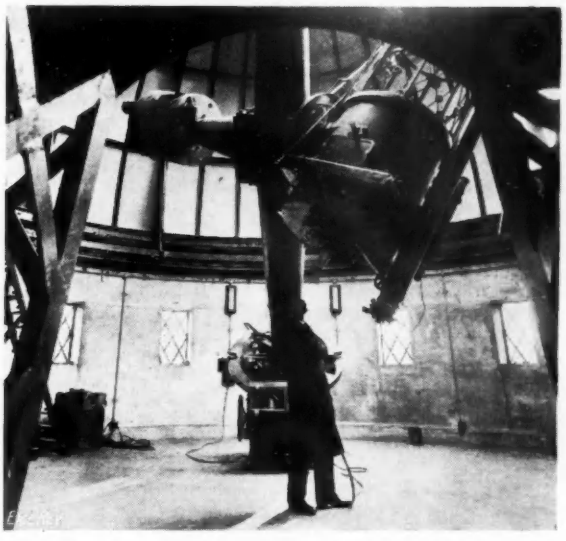
Mr. J. A. Sumner, referring to thirty miles of ring mains which had been up for about two years, said that within the last four months four pole boxes had been put out of action and a number of carbon tetrachloride fuses had been blown when normally one would not expect lightning to cause any trouble. Mr. W. H. Cooke said that, having been interconnected with Aylesbury for some years, he always knew when



More and more the boiler house of the modern "super-station" comes to resemble the nave of a cathedral. The Barking "B" boiler house described on page 149 and illustrated herewith is a good example of this similarity

there was a thunderstorm in the neighbourhood of Aylesbury. A curious feature was that in cases of transformer damage, the transformers were about three miles from the end of the line. He assumed this was due to a reflex throw back from the end of the line, the surges piling up, so that the transformers at the extreme end did not go down. He frequently had cases of earth leakage switches tripping due to atmospheric disturbances.

The author, replying, contended that thunderstorms depended



This new 36-in. reflecting telescope by Sir Howard Grubb, Parsons & Co., which is electrically operated, has recently been installed in one of the Greenwich Observatory buildings

entirely on the movements of the winds, temperature, pressure, and humidity gradients in the atmosphere, and were not influenced by the physical structure of the earth.

* * *

Experiments in Magnetism

Among the papers to be presented before the PHYSICAL SOCIETY in London to-day is one by Messrs. S. R. Rao and G. Sivaramakrishnan, which describes a new method of determining experimentally the magnetic susceptibilities of gases and vapours. Compensation is effected for the test bulbs; and the influence of surface condensation, if any, of gases and vapours can be allowed for and investigated separately. Electromagnetic retorsion is employed, and the arrangement is rendered independent of small changes in the magnetising current. The molar susceptibility of carbon dioxide was found to be $-(20.79 \pm 0.08) \times 10^{-6}$, showing good coincidence with the values of other investigators. In another paper Mr. L. R. Wilberforce explains how he has determined the relation between the magnetic fields round a uniformly magnetised ellipsoid when in a vacuum and when immersed in a permeable medium. The probability that the field round a thin, normally magnetised shell is independent of the permeability of the medium surrounding it is discussed.

Street Transport Developments

Engineering developments in street passenger transport provided the subject of an address by Mr. E. R. L. Fitzpayne, the chief technical assistant of the Edinburgh Transport Department, at a meeting of the INSTITUTIONS OF ELECTRICAL AND MECHANICAL ENGINEERS in Glasgow last week. Mr. Fitzpayne said that the main advantage of the electric vehicle over the motor bus was that the price of the fuel was not subject to violent fluctuations, but unless electrical energy could be purchased at a cheap figure electric traction was bound to disappear in this country. In fact, it had already disappeared in a number of the smaller towns in Scotland, a country which, with its available water power, should be in the van of electric traction. Due initially to the price of energy, great strides had been made in the production of an efficient regenerative motor for street transport. One car in Edinburgh had been so equipped. The latter development was the result of exhaustive tests of a car equipped with high-speed series motors, one with series motors and field weakening, and one with regenerative compound motors. Tests showed that the regenerative car was smoother in action, had better acceleration, and decreased the wear on the track, tyres, and brake-blocks.

Guidance for Youth

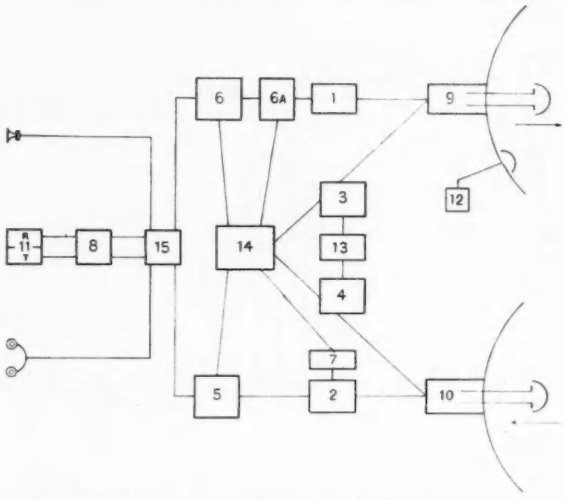
Mr. J. Parkinson, in his presidential address to the members of the BIRMINGHAM ELECTRIC CLUB on January 26th, urged the need for closer co-operation between employers and the education authorities with a view to preventing human misfits in the electrical industry. He hoped the club would increase its sphere of usefulness by establishing a section to which youths leaving school could apply for information and guidance in order to prevent the possibility of their entering a branch of the industry for which they were not equipped. It would be well if educational authorities were supplied with details of the requirements of electrical employers.

Micro-ray Telephony

Inauguration of a service between British and French airports

THE civil airports at Lympne, Kent, and St. Inglevert, France, have been linked by a micro-ray wireless communication circuit. The service is said to be the first of its kind to be established on a commercial basis, and it has been provided jointly by the British and French Air Ministries. The inaugural ceremony was performed on January 26th by Sir Philip Sassoon and M. Delasalle, Under-Secretaries of State for Air for the two countries.

The new service will speed up communication between the two aerodromes and replace the present system of transmission



Micro-ray terminal arrangement for telephony or teleprinter

1. Modulation circuit. 2. Demodulation circuit. 3. Transmitting tube control. 4. Receiving tube control. 5. Receiving amplifier, gain control. 6. Transmitting amplifier, gain control. 6a. Auxiliary transmitting amplifier. 7. Oscillator (500 kc.). 8. Oscillator V.F. 3,500 P.P.S. 9. Transmitting tube. 10. Receiving tube. 11. Teleprinter "Creed." 12. Radiation indicator. 13. Meter panel. 14. Power supply. 15. Telephony-teleprinter change-over device.

by land-line from Lympne to Croydon and thence by radio to France. The contract for the Lympne station has been executed for the Air Ministry by Standard Telephones & Cables, Ltd., while the St. Inglevert plant has been erected by their associated company, Le Matériel Téléphonique, of Paris.

Power of the order of 0.5 W is radiated from aerials less than an inch long on a wavelength of 17 cm. (claimed to be the shortest so far used commercially), as compared with 900 m. for civil air traffic and 1,380 m. for route traffic messages. The wavelength used for reception is 0.5 cm. longer than that used for transmission, which slight "stagger" permits duplex working by telephone and "Creed" teleprinter. Hitherto wireless teleprinting has been done experimentally only, owing to the difficulty of obtaining a radio signal of constant strength and free from interference. The micro-ray system overcomes this handicap and messages will be transmitted at a speed of sixty to seventy words per minute.

The distance between the two terminals is 56 km. and the path between them is clear of obstacles, the electro-optical equipment being installed on the roof of a hangar 43 ft. above ground at Lympne, and on 66-ft. steel towers which have been erected at St. Inglevert.

For generating the oscillations at the rate of 1,700 millions per second use is made of a specially designed micro-radion valve, fitted with a double-ended helical grid and a normal cylindrical plate electrode. The double-ended grid, in addition to being biased positively, is included as a tuning element in the main oscillatory circuit. The actual wavelength is a function of valve geometry, output circuit, and electrode voltages; the latter are therefore the tuning elements. The normal control function of the grid is not used; it is the "oscillating electrode," while the "plate" is the "reflecting electrode." The latter is biased negatively, and there is no plate current; the grid is biased positively, and in many respects replaces the anode of a normal valve. For example, the grid dissipates the power lost in the valve. The filament is of tungsten, and is operated at a temperature giving voltage saturation of the space current with respect to the oscillating electrode.

Electro-optical Systems

The main reflector is paraboloidal, 10 ft. 6 in. in diameter, and is spun out of an aluminium sheet about 5 mm. thick. A spherical reflector, three wavelengths in diameter, faces the large reflector, to which it is attached by three radial wooden members. The antenna, of the half-wavelength type, is placed at the focus of the paraboloidal reflector, which coincides with the centre of the spherical reflector.

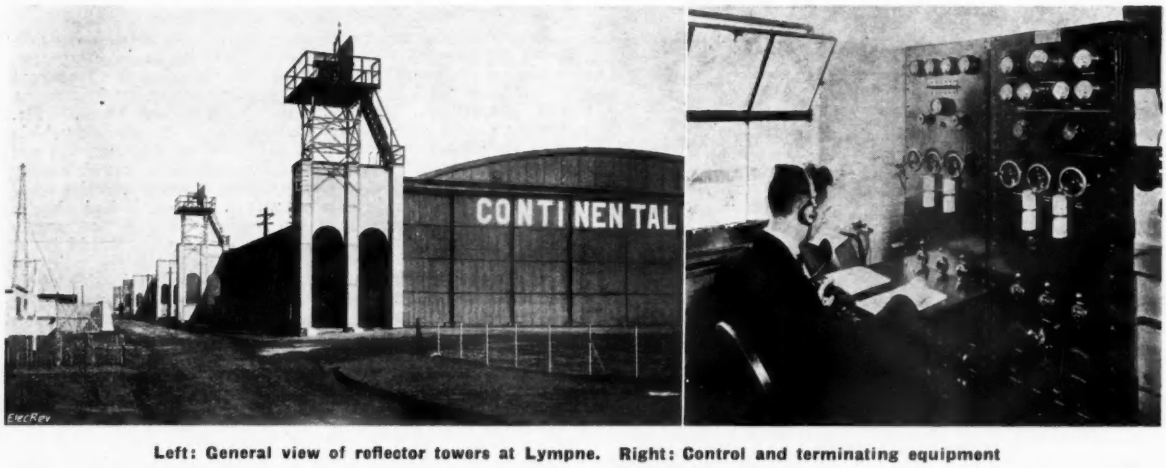
The focus of the paraboloidal reflector is situated in the aperture plane of the spherical reflector, and the radiation emitted from the antenna on the transmitting side is concentrated into a very sharp beam by means of the main paraboloidal reflector. The spherical reflector is used to reflect the direct forward radiation of the antenna back to the paraboloidal reflector, thus increasing the gain of the total electro-optical system. The gain of the paraboloidal reflector alone is of the order of 28 decibels, which rises to 31 decibels when the spherical reflector is added to the system. The same gain is obtained on the receiving side.

The antenna is fed by a concentric transmission line, the external surface of the outer tube being tapered, and of great rigidity to prevent antenna movement on windy days. The inner member is insulated by "Micalex" spacers located at the voltage nodes the purpose being to keep the loss as low as possible.

Behind the large reflector the valve is mounted in a socket of the conventional bayonet pattern, but the two lead-in wires to the oscillating grid electrode of the valve are adjustable in relation to the transmitting line in order to tune the oscillatory circuit of the micro-radion valve on site. The length of the tubular transmission line is made equal to three-fourths of the wavelength used, to match the impedance of the antenna to the internal impedance of the valve, and thus give optimum working conditions. Adjustment of the tube is by a screw and small hand-wheel. All surfaces conducting high-frequency currents are gilded by a galvanic process to prevent corrosion. Other metallic parts are painted.

On the transmission side, the auxiliary transmission line is connected to a thermo-couple, and an associated galvanometer in the control room acts as a radiation indicator.

Apart from the adjustment of the oscillatory circuit and transmission line, which does not have to be changed except



Left: General view of reflector towers at Lympne. Right: Control and terminating equipment

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

Direct-current Transmission

In your report of my remarks made at the meeting of the I.E.E. on January 18th you did not find space to insert the particulars which I gave showing that on a 1,200-mile (double) line, transmitting 400,000 kVA at 370 kV (a line 33 per cent. longer than the proposed Norway-Germany line), the reactive drop of the line could be entirely wiped out and its power factor kept at unity back to the generator, with nothing worse than an average increment in the main-line current of some 2 per cent. The additional reactive drop due to this 2 per cent. could be compensated for easily at an additional increment in the main current of roughly 0.05 per cent.

I took 370 kV because the flexibility conferred on the a.c. scheme in avoiding corona when going over mountain ranges, and in other respects, warrants a 20-30 per cent. increase in the sub-station pressure (incidentally saving in resistive drop also). It would give me pleasure to show, confidentially, to any of your readers who are really "commercially interested" the calculations referred to. An extension of transmission from, say, 200 miles to 1,200 miles, which is in addition free from instability, would surely be a result worth striving for.

Birmingham, *January 27th.* A. M. TAYLOR.

Engineers and Economics

It is a hopeful sign when engineers and scientists begin to inquire why the benefits they are conferring on humanity are being wasted. They realise the fact (ignored by politicians and orthodox economists) that the basic reason for all productive effort is the maintenance of the race. If the Engineers' Study Circle will start from the simple basis that the welfare of all the country's people is the paramount consideration, and that economic and monetary systems are only justified in so far as they serve human welfare, it should not be difficult to produce constructive proposals that will lead to general prosperity.

Various schemes of monetary and industrial reform have been propounded during recent years, some of which hold promise of success if they could be applied. It is a suitable task for minds which are trained to think logically, to examine all such proposals, as well as the productive potentialities of the country, and present a sound scheme for social and industrial recovery. No class has a greater claim than technical men to urge a scheme of reconstruction.

The movement recorded in your issue of January 19th should receive the widest support from technicians, without reference to party politics or personal bias; the time has come for those who have given us plenty to ensure that their efforts are not distorted into an excuse for inflicting poverty.

HORACE R. HOCKLEY, B.Sc., A.M.I.Mech.E.

Birmingham, *January 27th.*

Women and the Electrical Home

In a daily paper there recently appeared an article by Miss Wilkinson entitled "Women Cold-shoulder the Electrical Home." She mentioned the "Women's Electrical Association" in a casual way, and I hope that her views are backed by that Association and that the Association will be able to secure public control of appliances in connection with the use of electricity in the ordinary small or moderately sized English home.

To my mind the chief value of that article lay in the fact that it voiced the point of view of the chief user—the woman in the home. Miss Wilkinson maintained that the housewife was standing aloof doubting, owing to her fear of the fuse-box. Too often experts who knew a great deal about electricity could not visualise the requirements of the ordinary citizen.

The article showed that the first essential was safety. There must be everyday accidents all over England from faulty apparatus or faulty wiring, few of which are publicly reported.

Lady Moir opening the London School of Electrical Domestic Science which is referred to in our "Business Notes." With her are Miss Minoprio (principal) and Mrs. Major (director)

People get burned or shocked by touching simultaneously an earthed object such as an electric cooker or a bath, and a leaking electric fire or lampholder.

As a designer of wiring material I have tried to put myself in the position of the woman in the house and to design for her benefit, but I do not find that this point of view is always foremost in the mind of people responsible for getting electrical appliances into the ordinary house.

Here is one striking example. My firm was asked to quote for a large quantity of lampholders for a toy article to be operated by the ordinary mains supply. I mentioned the question of safety for the children and the manager of the firm which was putting the article on the market replied: "I don't care what happens after we have sold it." I made up my mind then to have nothing to do with this business. Another reply often heard is: "We have never had an accident before."

R. NETTLE, *Managing Director.*

Manchester, *January 24th.* Victor H. Iddon, Ltd.

A Prepayment Meter Problem

Replying to Mr. Wilson's letter in your issue of January 19th, I would suggest that fixed-charge collectors of the mechanical type are too expensive and must increase the cost per kWh. Then, again, they may be burgled. The charges for "assisted wiring" through a prepayment meter, involving the amount of some 3d. per kWh, make it impossible for such consumers to be encouraged to use domestic apparatus, and we should be better without them as lighting consumers alone.

My council of course carries out 98 per cent. of the wiring installations in the town with its own wiremen; this gives us a chance to control the price of installation. We always install C.M.A. cables, the highest possible grade of switches

Micro-ray Telephony (*continued from opposite page*)

in the event of the valve burning out, all control adjustments are located in the control room on a number of panels mounted on two vertical bays.

Potentiometers control the voltages applied, and modulation, which may be speech or 3,500-cycle signals coming from the teleprinter unit, is increased in amplitude by means of two amplifiers. The first is an ordinary transformer-coupled two-valve amplifier of the repeater type with attenuators for gain control, and the other is a push-pull output stage employing three valves. Signals coming from the amplifiers are applied to a voltage divider which supplies the modulation to the electrodes of the micro-radion valve in a suitable ratio.

Incoming signals are picked up by a receiving reflector, focused on the receiving antenna, and demodulated by means of the micro-radion valve. To stabilise the demodulation process an auxiliary oscillator applies a 500 kc voltage to both electrodes of the receiving valve in a different ratio, which is determined from the constant frequency curve of the valve in the same way as the corresponding ratio for the modulation on the transmitting side.

It is stated that this method renders the adjustment of the system much less critical in operation. The demodulated signal is then fed into a receiver amplifier and gain control panel and passes into an ordinary telephone receiver, or is transmitted to the teleprinter equipment for a second demodulation used in conjunction with a single-current voice-frequency equipment.

The signal distortion is very small, and the circuit includes a device to maintain the detected current approximately constant over a wide variation of signal strength. Since the teleprinters operate on the start-stop principle, there is no need to synchronise the transmitting and receiving machines. Further, the operation of the voice frequency unit and the radio system is simplified by reason of the fact that the speed of the signals sent out is independent of the rate of striking the teleprinter keys.

and lampholders, and other accessories. We charge 1d. per point per week. We also charge for electricity at the rate of 1d. per day up to a house with six rooms, to cover the fixed charge. This is conditional on the consumer installing a washboiler, breakfast griller or water heater, for which a charge of 2½d. per week is made, electricity for all purposes being supplied at ½d. per kWh.

This scheme was primarily introduced for the purpose of increasing the consumption of electricity for purposes other than lighting by those consumers who now are paying for their wiring installation through a prepayment meter at the rate of 3d. per kWh, and it is hoped that it will supersede the older and restricted method. With a five-roomed house (five points), the charge per point is 5d. a week and the fixed charge 7d. A washboiler or equivalent costs 2½d. per week, giving a total of 1s. 2½d. per week.

Barking power station is in an isolated situation near Barking Creek and consequently full provision has to be made for the feeding of the staff. Our picture shows the kitchen, which is naturally equipped with up-to-date electric cooking apparatus

The amount is collected regularly each week. There appears to be no difficulty and it is not costly, as a man can collect 100 charges per day. In the case of the Council's houses the charge is 9½d., since the wiring has already been installed by the Housing Committee. The collection of this costs nothing as the Council's collector is already visiting the houses for the rent. All current is then charged for at the rate of ½d. per kWh.

Consumers do not miss the small weekly contribution which is collected at the door regularly. The quarterly bill, on the other hand, is often a serious problem, not only for electricity but every other service. The advertising possibilities of this scheme are also worth considering.

A. J. HUTCHINSON, *Engineer and Manager*,
Farnworth U.D.C. Electricity Works.

Farnworth, *January 22nd.*

I quite agree with Mr. Wilson (ELECTRICAL REVIEW, January 19th) that there is a growing tendency for small consumers to adopt the prepayment meter. If a weekly system of collection could be arranged I should think it would overcome Mr. Wilson's difficulty if a quarterly meter provided with a double winding on the series laminations, metering lighting and power by one meter, were fixed instead of a two-part tariff meter. A varying scale of charge would be arranged, the price per kWh being reduced as more energy was used. Printed cards with details of charges would be provided, and each week the inspectors would read the meter and collect the cash.

This system would not prove satisfactory in many districts as the staff necessary to complete the survey each week would be too great. I know of no other method than the prepayment meter; of meters for varying the price per kWh, the two-part tariff meter, which changes its price as the load is increased, is, I think, the simplest one to explain to the consumer. The consumer has not to wait until so much energy has been consumed before the price is changed; whenever an appliance is used lighting can be obtained at the " power " rate.

The above systems give small domestic consumers similar benefits to those provided for quarterly accounts. The lack of development in the case of both these classes of consumers is, I think, chiefly due to the wrong type of publicity. There still exist to-day a large number of people who think electricity is expensive, who have asked for a supply and when it is installed are provided with one meter only. The small consumer thinks that if he has a slot meter, radiators and other appliances are prohibited owing to the high price per kWh.

One seldom sees the various tariffs advertised in the showroom window; more important than the price of the iron or kettle is the maintenance cost. Why not show the two-part tariff meter (called in some areas the " household meter "—a more attractive name) and offer lighting at, say, 2d. per kWh whilst using a kettle, iron, bowl fire, &c. By co-operation between the supply undertaking and the contractor more appealing publicity could be arranged and a cheaper tariff could be brought before the notice of the consumer before he complains; the consumption per hour conveys very little to him—pence per hour is more enlightening.

Mr. Wilson suggests a combination of meter cash collector or inspector and canvasser. I do not think this would prove practicable; a collector inspector has a fixed number of meters to attend to each week and the canvasser should be free from this. He may have to talk to a dissatisfied consumer for an hour or more. A broken plug put right gives satisfaction, and an explanation of the account which if rated under a different tariff would perhaps reduce the bill may clear another grievance. I have provided all meter readers and inspectors with " complaint books " in which all consumers' complaints, meter and installation faults are noted. Complaints are given in each day, sorted out, and attended to. When one person sees every " complaint note " a close watch is kept on the whole system and much valuable information can be tabulated, which is a guide for the testing department, the installation department, and the consumers' engineer.

January 23rd. K. M.

When two-part tariff prepayment meters came into prominence again recently, I had cause to consider the fundamentals of the problem at present facing supply engineers. In spite of the remarkable success obtained in some quarters by its adoption, I could not help coming to the same conclusions as Mr. Rendell-Baker that, taking the long view, the system could not hope to survive. At the best it is only a palliative suitable for tiding over a transition stage. The scheme has been foisted on us, first, as a result of economic depression and the inability of consumers to pay cash for quarterly bills, wiring installations, &c., and, secondly, to the apathy still prevailing towards using electricity in bulk for all domestic uses.

If we are to succeed in selling electricity on a really large scale (and domestic use will eventually outstrip industrial consumption) then the price per kWh must not be artificially bolstered up. The consumer by his own experience must become convinced that electricity is a cheap necessity. There is no reason whatsoever why the convenience of collecting wiring charges, hire-purchase charges, &c., should be made an excuse for the adoption of a system of charging which may jeopardise rapid expansion. The two charges should be kept absolutely distinct so that the consumer has in front of him only the running charge, unfettered by other complications. By making this low enough, expansion of sales will automatically follow.

When sales have grown, the application of the two-part tariff prepayment meter will not be so severely felt, as the average cost will then be very much below what can be achieved at present, and the consumer will already have had his taste of cheap service, sufficient to whet his appetite for more.

Mr. Rendell-Baker's description of the Venner meter is apt to give the impression that the time collector was specially developed for Croydon. About three years ago I also thought the idea was original and went as far as to lodge a provisional specification. At the time I had in mind producing a collector to sell at 30s. to 35s., for which even yet I believe there would be a wide market. On further investigation, however, I found that meters of this description were already available, both in this country and abroad, although very much more expensive, and, in fact, I traced original patents covering the complete system as far back as 1926. It would be interesting to know if there are any proprietary rights in existence covering a collector on a time basis, or whether the system is open to any manufacturer. A. PAGE, B.Sc., A.M.I.E.E.

London, S.W.16, *January 27th.*

I have been rather puzzled by the lengths to which some engineers will go to avoid using a simple two-part tariff slot meter. The only objection put forward is that such a meter is too complicated to be understood by the average domestic consumer. In the case of one of your correspondents it appears that he did not give the consumers a chance to exhibit their alleged lack of intelligence.

It has been my duty to explain the operation of the two-part tariff slot meter to a good many engineers all over the country, and although at first (some years ago) when it was a novelty, some engineers found it difficult to follow the internal operation of the meter, it was generally admitted that so far as the consumer was concerned the meter was simple. In fact this has been proved to be the case by the number of repeat orders placed for these meters after the consumers were given an opportunity to prove that they had an average amount of common sense.

Experience shows that it is quite unnecessary to complicate metering by installing both collectors and quarterly meters. Furthermore, the fact that a quarterly bill has to be met apparently has the effect, according to your correspondent, of restricting the domestic consumption to only three times the lighting load, which in the average flat amounts to perhaps 300 W. Supply authorities using two-part tariff slot meters usually find that they have to cope with loads twenty times as great as the lighting load. H. HORWOOD.

London, S.W.1, *January 26th.*

Variations in Distribution Voltage

"Supply Engineer's" reference to myself almost disarmed me. However, we must have a common ground. We are dealing with (1) voltage variation, not voltage drop; (2) the supply to a consumer some distance from the end of the low-voltage line: (3) the tail-end booster. The last I define as an automatic tail-end booster; the non-automatic I have never seen; it must be an abomination, and I am surprised "Supply Engineer" is using this.

When I referred to no measurable drop taking place on the h.v. line I meant in rural supply. To the north of Aylesbury there is 100 sq. miles; each village has the supply, yet I am sure that a single three-phase line consisting of 7/12 steel wire would have been ample to have supplied the whole of the load in this area with a voltage drop well under 4 per cent. For the purpose of duplicate supply and the future I have run two copper feeders into this area with no measurable drop.

I would supply a consumer one mile away by means of a 5-kW step-up transformer from 460 V single-phase at the village to 11 kV single-wire, earth return at a cost as shown, including a step-down transformer to 230 V for the consumer. The current would be about ½ A, so that there would be no measurable drop on the transmission, and the variation in voltage would be well within the 4 per cent.

	£	s.	d.
Fifteen poles	16	10	0
7/12 steel wire	11	0	0
Thirteen insulators and pins, and two strainers ...	3	4	4
Two earth-plates, two stays, fifteen danger plates, 150 yards barbed wire	6	18	6
Two 5-kVA transformers, 30-A fuse and meter cupboard	33	10	0
L.v. lines and service	7	0	0
Labour (fifteen man-days) and cartage (ten miles) ...	20	10	0
	£98	12	10

Assuming capital charges at 6 per cent. a m.d. of 350 W at £3 10s. per kW, 2,500 kWh at 0.3d., and adding transformer iron losses, the total annual cost would be £12 17s. The annual revenue would be: base area 1,100 sq. ft., £5 0s. 10d.; 2,500 kWh at 1¼d.; transformer iron losses, £2 10s.; total, £20 11s. 3d. The annual gross profit would therefore be £7 14s. 3d.

The Aylesbury charges to rural consumers are: 11d. per 10 sq. ft. base area, about 18 per cent. of the rateable value; and 1¼d. per kWh, all above 1,000 kWh per quarter 0.55d. "Supply Engineer's" prices are too low; at ¾d. he can hardly hire out cookers, with the result that he may have no cooking load, which is decidedly profitable at about 1d. per kWh. He will probably have a large load at ¾d. for heating—a most undesirable load compared with the cooking load.

By widely scattered consumers I presume he means the ribbon type of building along a main road which may extend for two or three miles. Here, if the single-phase h.v. supply is run down the back of the houses, transformers can be placed at intervals along the road to supply the consumers with a voltage drop that is certainly within the 4 per cent. If the earth return suggested above was not acceptable it would not cost much to put up a lightly insulated return wire.

There is profitable work to do—let us do it and not moan about regulations and in the next breath moan about lack of regulations as "Supply Engineer" seems to be doing.

W. A. TURNBULL,

Aylesbury, *January 29th.* *Borough Electrical Engineer.*

This Prosperity

It is apparent that the wrangle developing between "Admirer" and Mr. A. J. Abraham is losing sight of the main point raised in the first letter printed under the above heading. The criticism was levelled at the electrical industry in general—and quite rightly too—that men who have studied hard and obtained the qualifications which are a requisite to obtaining a responsible position these days should be paid such ridiculously low salaries, which, for very obvious reasons, are accepted. Yet it is absurd to compare these salaries with that of an "efficient dustman."

The social status and mode of living are entirely dissimilar, and so long as a man does his duties satisfactorily he should not be paid a degrading salary which obviously must affect his enthusiasm for his work. As long as employers will persist in this short-sighted policy so long will they receive third-rate service from first-rate men. S. G. GREEN.

Stafford, *January 29th.*

During the industrial depression the electricity supply industry has continued to make progress, the supply companies have maintained dividends, share capital has increased in value, and in some cases bonus shares have been issued to shareholders. But what of the employés in this prosperous industry?

The majority of men on the E.P.E.A. schedule are receiving less salary (due I acknowledge to the cost-of-living basis) than some years ago, but these same men have been instrumental in putting the supply industry on this better financial basis. Therefore I ask is it not time that the E.P.E.A. woke up from its lethargy and obtained a revised schedule and fewer working hours for its members? The mains engineer and office staff work in the majority of cases considerably shorter hours than the shift engineer, and I feel that the time has arrived when the shift engineer who is still working forty-eight hours per week should be taken into consideration.

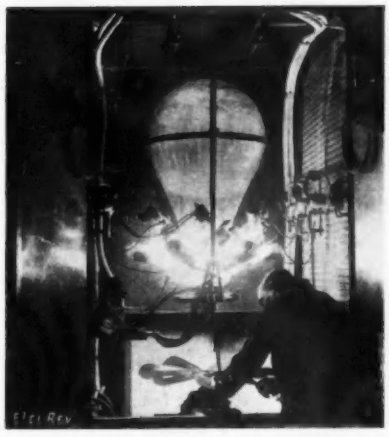
There is undoubtedly a supply of abundant and qualified engineers which the industry could absorb so that a shorter working week could be successfully and profitably worked.

January 24th. NUANCE.

A Charge of Discourtesy

Under this heading a correspondent in your issue of January 26th makes an interesting point. Doubtless many of your readers have suffered similar experiences or even more discourteous treatment.

Some time ago I applied for a post of assistant engineer, advertised under a box number in your columns. In due course I had a reply and was asked to forward a photograph of myself and also to state whether I could be present for an interview in London on a specific date if required. The interview date passed and I heard nothing further of my application and concluded that I had been unsuccessful. However, a full fortnight after the interview date I had a further letter in which I was asked whether I owned a car or motor cycle and at what rate I would be prepared to use either on the company's business. I own neither, and have had no further reply from the advertiser, nor so far as I know was the post advertised as filled!



One of the new mercury arc rectifiers which have been installed by the L.M.S. Railway Co. at its new Euston offices. Similar equipment is to be provided at St. Pancras, Broad Street, and several other of the Company's stations

A further point that occurs to me is the fantastic imagination applicants are often expected to have: many advertisements are worded very ambiguously—often like telegrams. Your rates are surely low enough to allow for clearly worded announcements at moderate cost. I have often wondered why it is necessary for so many employers to advertise under box numbers (these are nearly always the ones who fail to make use of your "Appointments Filled" column). By advertising in this way they are doubtless inundated with many applications which they would not receive if the applicants knew to whom, where and for precisely what they were applying. A carefully prepared application with copies of testimonials (which are never returned) takes considerable time and thought, and surely advertisers could save trouble both for themselves and the applicants if they gave fuller information and more often stated in what district the work would be. APPLICANT.

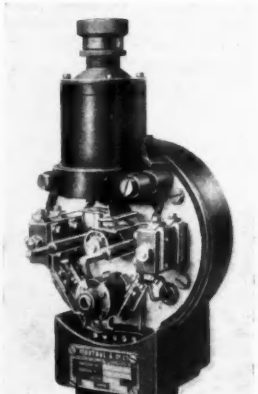
January 28th.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Regulating Generator Voltage

The range of "M.S." automatic voltage regulators supplied by MESSRS. ISENTHAL & CO., LTD., Ducon Works, Victoria Road, North Acton, has been extended from a maximum capacity for a.c. generators of 50 kVA to nearly 300 kVA. This has been done by increasing the exciter voltage so that the field current still remains at a low value. For d.c. machines the limit is usually about 50 kW, as this is generally the maximum size for which field currents of 5 A at 110 V can be operated.

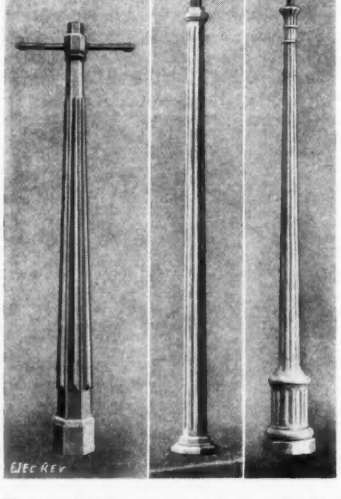


An Isenthal "M.S." voltage regulator

The contacts of the regulator, vibrating at high frequency, periodically short-circuit the rheostat or insert resistance by the operation of small eccentrics fitted to a spindle driven from the dynamo. The relative positions of the short-circuit contacts are determined by a solenoid connected across the terminals of the machine. For the control of a.c. generators the solenoid is operated through a potential transformer and double-wave rectifier.

Concrete Lamp-posts

Generally speaking, concrete lamp columns are more pleasing in appearance than iron or steel, besides being less brittle than cast-iron and non-corrosive. CONCRETE UTILITIES, LTD., Great Amwell, Ware, Herts, claim that the prices of their new range of reinforced concrete columns are below those of steel or iron of similar strength and height. A great variety of shapes is available at from £3 to £5 15s., and although a coat of paint may be used for colouring it is unnecessary from the protective point of view. Three typical columns are illustrated.



Three modern concrete lamp columns

A Cork-rubber Composition

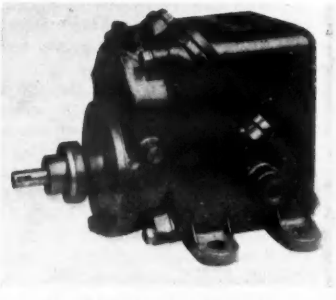
A new composition, entitled "Kautex," has been designed to combine the qualities of cork with the strength of rubber. Although the percentage of rubber which is used as a binder is high, it is claimed that the composition does not spread when used as jointing or packing, and that its ability to absorb vibration is equal to that of tough sponge rubber; but unlike the latter, it will not collapse under compression. The specific gravity is much lower than that of rubber. It can be supplied in plys of from 1/32 to ¼-in., which can be built up to produce any thickness required. The amalgam is supplied by MESSRS. KAUTEX (PLASTICS), LTD., Empire Works, 9, Deansbrook Road, Edgware, Middlesex.

Hack Saws for Electrical Purposes

MESSRS. FRY'S (LONDON), LTD., 24, King Street, London, E.1. inform us that they have now turned their attention to the manufacture of hack saws expressly for the electrical trades. The type "Enox-T.T." is a flexible blade of special temper, particularly suitable for cutting conduit rapidly. For cutting steel-tape-armoured cables, type "T" has been introduced, while for wire-armoured cables there is type "W"; both types will cut through the bitumastic composition of cables. The three patterns are priced at from 33s. 4d. (8 by ½ in.) to 50s. (12 in. by ½ in.) per gross, and should prove of considerable value to distribution departments and cable contractors.

Electrically Operated Speed Indicator

Many improvements have been incorporated in the new design of the d.c. generator made by Messrs. ELLIOTT BROS. (LONDON), LTD., Century Works, Lewisham, S.E.13, for use in connection with their electrically operated speed indicators and recorders for rotating machinery. The case is now made of non-corrosive aluminium alloy, instead of cast iron, reducing the weight from 38 to 18.5 lb. The dimensions are: Height, 7.8 in.; width of case, including fixing lugs, 8 in.; overall length, including shaft but with pulley, &c., removed, about 11 in. The generator may be mounted in any position and gears are oil-immersed while running. All bearings are carried on ball races. A clutch, self-contained in one case with the gear-box, can be provided to enable the generator to be disengaged from its drive for cleaning or renewal of brushes without stopping the machinery from which it is driven, or to avoid the necessity of running the generator except when specific indications are required.



An Elliott speed indicator

The fixing lugs have slightly elongated holes permitting some adjustment of the tension on the belt or chain. A slide rail base can be fitted to give a greater degree of adjustment, both laterally for alignment and in line with the direction of the drive for tensioning. The magneto can be arranged either for direct, belt, chain, or gear drive. A series of interchangeable gear wheels enables the magneto to be run at the most suitable speed in relation to that of the apparatus whose speed is being measured.

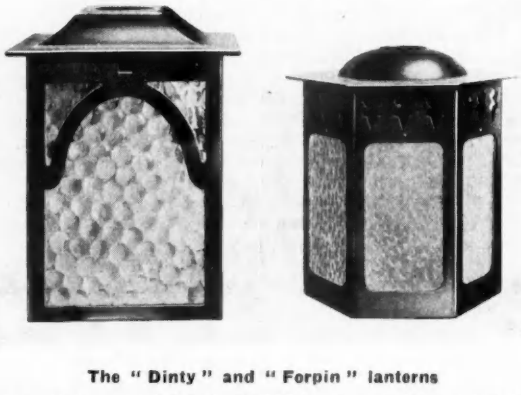
A Rubber Table Lamp

An all-rubber lamp standard has been placed on the market by MESSRS. DAVID MOSELEY AND SONS, LTD., Chapel Field Works, Tipping Street, Ardwick, Manchester, 12. It is made of solid rubber, which entirely abolishes any risk of shock, and the rubber is polished and finished in plain and mottled colours. The standard will not scratch polished furniture, and it cannot be broken through being knocked over, for whilst it is resilient enough to withstand all ordinary jolts and handling, it is quite rigid enough for normal use. It is also possible to wash the standard with warm water and soap to remove any dirt, as the colouring cannot be washed off. The price is 10s. without shade, lampholder or flex, but with a ⅝-in. lampholder adaptor moulded in.

The "Moslite" lamp standard

New Hall Lanterns

We illustrate below two hall lanterns which have recently been introduced by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2. Both have the metalwork finished in oxidised copper, with "dimpled" glass, and the prices are 2s. 6d. for the "Dinty," and 3s. 3d. for the "Forpin."



The "Dinty" and "Forpin" lanterns

(*Continued on page 163*)

A Record-changing Radiogram

The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, announces the introduction of an automatic record-changing radiogram of the eight-valve superhet. type for operation on a.c. 190- to 250-V mains. For this the company claims "knife-edge" selectivity and great sensitivity, and it embodies automatic volume control and noise suppression facilities. Tone can be controlled over a wide scale, and the tuning indicator is of the station-by-name type. Osram h.f. pentode, double-diode-triode and "Catkin" valves are included. The reception range covers the medium and long bands represented by 200 to 550 and 1,000 to 2,000 metres.

The G.E.C. record-changing radiogram

Twin loud-speakers permit reproduction both of radio and gramophone records without overloading or distortion. The "Magnet" 25-W induction motor runs at normal gramophone turn-table speed (78 r.p.m.) so that noise and loss of torque in gearing are eliminated. An automatic start and stop mechanism forms part of the equipment. The pick-up arm is compensated and spring-loaded towards the centre of the record, so that the needle will run into the music groove with minimum loss of time.

The record-changer is mounted on a pressed steel plate with all the controls in easily accessible positions. It deals automatically with eight 10-in. or 12-in. standard records. The apparatus is housed in a cabinet with grained and matched walnut panels. The dimensions of the cabinet are: height 33½ in., width 37½ in., and depth 20 in. The price is fifty guineas.

A Radio Relay Switch

A three-position sliding switch, which is manufactured under licence from Standard Radio Relay Services, Ltd., by SCREW MACHINE PRODUCTS, LTD., Wooburn Green, Bucks, has been sent to us for inspection. This switch, which has a brown moulded cover, is suitable for radio relay systems and can be obtained with resistance coils of 2,000 or 5,000 ohms.

A radio relay switch and two-pin connector

Particular care has been taken to ensure good contact in all three positions, so that there is an absence of crackling when the switch is operated. All the other relay products of this company, which include two-way connectors, moulded junction boxes, and pothead connectors, have high dielectric qualities.

Cadmium Yellow Automobile Lamps

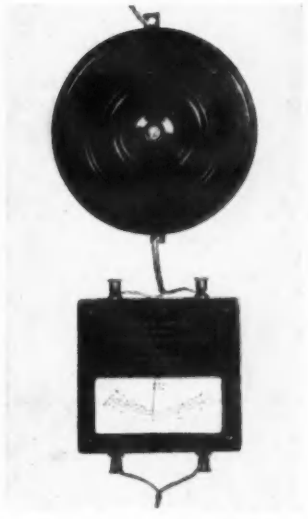
A new automobile bulb which, it is claimed, greatly reduces dazzle and is effective in fog, has recently been released by PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2. In introducing the cadmium yellow "Selectiva" bulbs, the company claims that the blue and violet rays of the spectrum, which are most dazzling and tiring to the eyes, have been eliminated. The yellow-tinted light is restful to the driver, and his vision is greater on account of the fact that his eyes respond with maximum sensitivity to light of this colour.

As regards its effectiveness in fog, with a beam of white light a considerable amount of back glare is experienced, but the tinted beam overcomes this obstacle as the yellow light is not reflected so much by the moisture particles of which fog is composed. It is claimed that headlights can be kept full on. We are informed that one of the largest transport undertakings in this country has specified these bulbs for its entire fleet. Prices range from 3s. 2d. to 5s., according to size.

Rapid Insulation Measurement

The RECORD ELECTRICAL CO., LTD., Broadheath, Manchester, has brought to our notice an instrument for the rapid measurement of insulation resistance in workshops and factories that make use of a.c. mains. The method thus obviates the need for providing either accumulators or special generators where a d.c. supply (which is required for the operation of every true ohmmeter) is not available.

The apparatus includes a transformer stepping up to the 500 V usually required for insulation testing, a Westinghouse rectifier, supplying a smooth d.c., and a 6-in. dial portable pattern workshop ohmmeter scaled in megohms. The rectifier or transformer box is capable of supplying more than one indicator. For low-range instruments under one megohm a rectifier is not necessary, as a battery can be used.

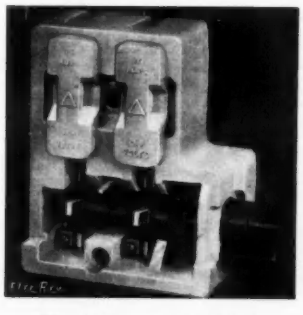


A "Record" ohmmeter

The indicators can be supplied in several ranges at about £15 each (list), the price varying with the range and voltage.

The "Apex" Switch-fuse

We illustrate below a new all-insulated switch-fuse which is being made by the FOSTER ENGINEERING CO., LTD., "Apex" Works, South Wimbledon, S.W.19. It bears the trade name "Apex," and affords complete protection to the user, for when the cover is removed the switch mechanism is locked in the "off" position, so that the blades cannot be forced into contact while the interior is exposed, and at the same time the cover cannot be removed until the switch is "off."

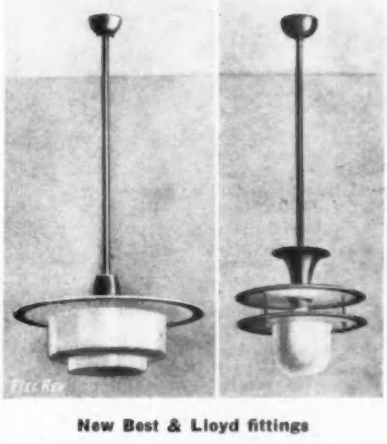


The "Apex" switch-fuse

The live terminals are set deeply into the porcelain and are well protected, while the switch blade is self-aligning to the contacts. The wiring is direct into all terminals, and the cover is flat, the captive nut being recessed and suitable for sealing. The rating is 15 A at 250 V.

Artistic Lighting Fittings

Among a range of new lighting fittings of unusual design which MESSRS. BEST & LLOYD, LTD., Handsworth, Birmingham, are placing on the market are Models 31343 and 31404, both of which are illustrated below. The former has a single light in an obscured glass cup, with 12-in. horizontal obscured plates with a clear band on the edge. It is 3 ft. long and will take any lamp up to 100 W, the prices being £3 15s. 6d. in polished aluminium and standard finish, and £4 2s. 6d. in aluminium and chromium plate.



New Best & Lloyd fittings

No. 31404 is 3 ft. 6 in. long with a 12-in. opal globe, above which is an obscured glass plate 19 in. in diameter with a clear edge. This model will take a lamp up to 150 W, and is priced at £3 5s. (standard finish) and £3 9s. 6d. (chromium plated).

New Books

Railway Track Circuits. By D. C. GALL. Pp. 231; figs. 78. London: Sir Isaac Pitman & Sons. Price 7s. 6d.

Modern railway transport is dependent upon an efficient signalling system for its operation, as this determines the degree of utilisation of the track and enables schedules to be maintained. The older signalling systems are entirely inadequate for present-day schedules with fast electric trains and short headways. Ultimately railways operating fast electric services with short headways will be forced to employ automatic signalling systems, in which the principal signal operations are effected by the trains themselves, manual operation being necessary only at junctions, terminal stations, and large intermediate stations.

Mr. Gall's book, therefore, is opportune as it gives concisely the theory of the electric circuits involved in the use of the track rails for signalling, together with practical data and numerical examples. The d.c. electric track circuit, with its associated relays and power supply system, is, in practice, not such a simple system as would appear from its circuit diagram on paper, particularly when the operating conditions require efficient and reliable operation at maximum economy of power. With a.c. track circuits the problems are considerably involved and require a good knowledge of a.c. theory for their solution.

The author tackles all these problems and demonstrates how they are solved. He gives the full theory of both d.c. and a.c. track circuits, and supplements this with sufficient general a.c. theory to make the reading easier for those who are not fully conversant with the latter. These features, together with the author's long association with and thorough understanding of the subject, make the book of great value to present-day signal engineers and to those responsible for the design, layout, and maintenance of track circuits.

Old-fashioned signal engineers who have been associated with non-electrical systems will probably find the book too mathematical. But the modern signal engineer should be a fully trained and qualified electrical engineer.

Technical Thermodynamics. By Prof. Dipl., Ing. W. SCHULE, translated from the German by E. W. Geyer. Pp. 627; figs. 324. London: Sir Isaac Pitman & Sons. Price 40s.

There can be no doubt but that many of the most important advances made in recent years in heat engines have been the direct outcome of purely mathematical research. It is in no condemnatory spirit that we venture to assert that the British engineer does not take too kindly to the more abstract realms of knowledge; he is essentially practical in his outlook, although the stress of international competition is gradually compelling him to keep abreast of theoretical science because from this important practical results are often found to follow with extreme rapidity.

We, therefore, welcome the very excellent translation which Mr. Geyer has given us of the late Professor Schüle's well-known work on technical thermodynamics. It is regarded as the standard treatise on the subject throughout Central Europe wherever the German language is spoken, and a wider understanding of its contents among British engineers might have a considerable effect upon the progress of the steam turbine and internal-combustion engine industries in this country.

The work is divided into two distinct parts. The first six chapters are devoted mainly to the laws of gases and so are applicable to internal-combustion engine problems, while the remaining four, which deal with the properties of steam and other vapours, are applicable to investigations on the steam turbine. The mathematical part of the work is very clearly set out. To bring the work into line with British practice the translator has converted the Continental units into British units.

There is much that is indicative of practical developments, such as the internal-combustion and the binary-vapour turbines, and we therefore recommend this book to the serious study not only of students and research workers but also to the designer and the consultant.

The Electromagnetic Field. By H. F. BIGGS. Pp. 158; figs. 38. London: Oxford University Press. Price 10s. 6d.

The aim of the author has been to present the classical theory of the electromagnetic field in a concise form suitable for students having a thorough grounding in elementary mathematics who desire to take an honours degree in physics. The work is divided into five chapters, and covers static fields, electrodynamics, Maxwell's equations, energy and momentum, with a final chapter dealing with the electromagnetic field in the light of the special theory of relativity. The first chapter contains an elementary account of the vector calculus.

The ground covered is extensive for a book of only 156 pages, and the treatment is generally formal and compact. Although the work will be welcomed by students of the class the author has had in mind, it suffers from a lack of exercises for solution, which would enable the student to test his understanding of the subject. In addition to its appeal as a text-book on electrical theory, the work is of interest in the field of applied mathematics as it affords an excellent elementary exposition of the application of vector analysis to physical problems. The final chapter dealing with the special theory of relativity is of particular interest in this connection.

A striking example is afforded of the ill-advised choice of symbols for electrical quantities used by British and American writers as the same symbol is used for current and for the imaginary unit, in order, presumably, that the book may be intelligible both to electrical engineers and to mathematicians. While no confusion arises from this double use, its necessity emphasises the undesirability of the symbol for current chosen by electrical engineers.

* * *

Shorter Notices

In the 1934 edition of the *Mechanical World* Electrical Year Book (1s. 6d.) a complete rearrangement of the contents has been effected which will greatly facilitate reference. Almost every aspect which interests the industrial user of electricity is treated in detail, and the whole of the subject-matter has been thoroughly revised and brought up to date. The policy adopted in the last edition of including technical descriptions of proprietary products is continued in the new volume. The new edition of the Mechanical Year Book (1s. 6d.) contains, besides its usual features, which have been revised and brought up to date, two new sections on machine tools and press work.

"Smoke and the Atmosphere." The results of investigations upon the impurities in the air of a factory town, which were begun many years ago, and regularly pursued since 1916, have been collected together by Mr. A. J. Ashworth in a 130-page book (Manchester University Press, 7s. 6d.). It is comprehensive in treatment, and gives a large number of diagrams and statistics, which demonstrate the need for the greater use of electricity in big towns, if a healthy atmosphere is to be maintained.

"The Jute Annual, 1933." London: British-Continental Press. Price 12s. 6d. In addition to a comprehensive directory of the jute world, this annual contains trade figures and technical articles. The annual is in both English and German throughout.

"Planning, Estimating, and Ratefixing." By A. C. Whitehead. (293 pp.) London: Sir Isaac Pitman & Sons, Ltd. Price 10s. 6d. net.

In the Courts

IN the Chancery Division on January 26th Mr. Justice Crossman had before him a motion on behalf of the Mullard Radio Valve Co., Ltd., for an interim injunction to restrain until the trial the Rothermel Corporation, Ltd., from infringing one of the plaintiffs' letters patent.

Mr. Lloyd Jacobs, in support of the motion, said that the defendants had agreed to submit to a perpetual injunction in the terms of the notice of motion and to pay an agreed sum by way of costs. Mr. Briscoe, on behalf of the defendants, said they were willing to treat the motion as the trial of the action on the terms mentioned by Mr. Lloyd Jacobs.

His Lordship assented and a perpetual injunction was granted in the terms stated.

A 2,700-V Shock Survived

A Westcliff plumber-jointer who was said to have escaped with his life after receiving a 2,700-V shock was the applicant in a claim under the Workmen's Compensation Act at Southwark County Court on January 25th. He was Charles Barker, of Westcliff-on-Sea, the respondents being the Bermondsey Borough Council.

Mr. Duckworth, for the applicant, said that his client was engaged in the Electricity Department of the Borough Council at £5 7s. 1d. a week. While working for the respondents he was dealing with a wire which he thought was charged at 220 V, but was actually at 2,700 V. He received a severe shock, and was away from work seven weeks, having sustained burns on the face and hands. The accident happened in July, 1931, and he returned to work in the following September and started work on cables, but had nothing to do with live wires. His union took up his case and in March, 1932, obtained a declaration of liability against the Council. The Council's contention was that he was fit to resume his ordinary work in the September after the accident.

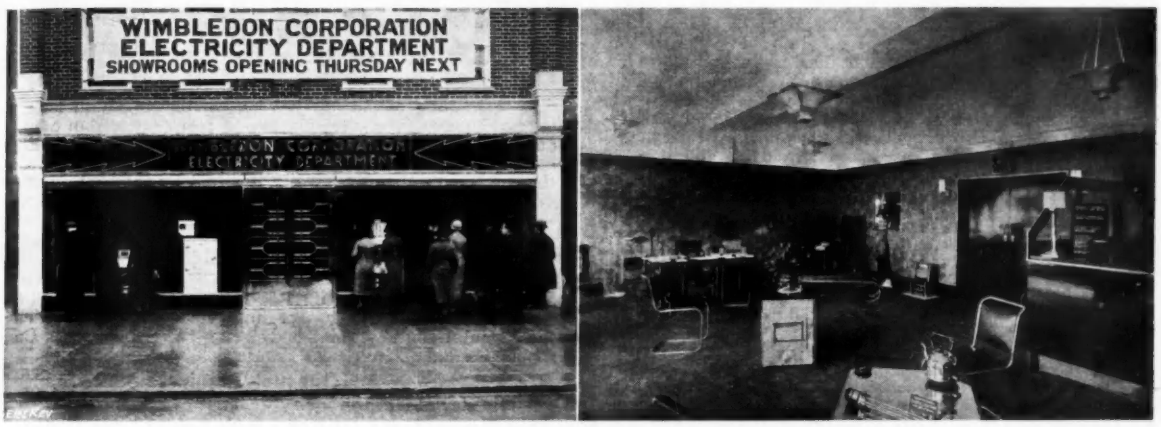
Giving evidence, the applicant said that on the day of the accident he was instructed to complete some electric light connections in Rotherhithe New Road. Adopting the usual course, he put his testing apparatus on the live wire and there was a terrific flash, knocking him over. He was subsequently discharged by the Council because he refused to do live wire work. His explanation was that he was physically capable of working on dead cables, but not when they were charged with electricity on account of the effect which the accident had upon him.

Medical evidence was called on both sides, the Bermondsey Council suggesting that Barker had recovered from the shock of his accident and was able to return to work. Judge Moore said that in his opinion the applicant was still unable to return to work and deal with live wires, and he would make an award in his favour of 30s. a week from October last.

Wimbledon's New Electricity Showrooms

THE urban district of Malden and Coombe is rapidly developing into a large residential area, and has become such an important section of the Wimbledon Corporation's area of supply that the Corporation decided to erect branch showrooms in Malden, and these were formally inaugurated by Lady Roney, Mayor of Wimbledon, on January 25th.

Ald. Hickmott, chairman of the Corporation Electricity Committee, who presided, said that a supply to the urban district from the Wimbledon electricity undertaking was commenced in 1911, when the number of consumers was only seventy-two, but the district developed so rapidly that to-day there were over 7,000 consumers providing a revenue of over £50,000. The proportion of consumers to the population was approximately 80 per cent., which compared favourably with many of the larger undertakings in this country. The Wimbledon Electricity Department offered the same tariffs in the urban district as those charged in Wimbledon, a concession not granted by many undertakings. The showrooms had been erected at a cost of £4,200, and he hoped that the residents would make good use of them.



Exterior and interior views of the new electricity showrooms at Malden

The showrooms are situated in the main thoroughfare and are most modern, having been constructed to the design of Mr. R. E. S. Harding, building surveyor to the Electricity Department. The shop front has two show windows with the entrance in the centre, and is constructed of "Staybrite" steel mounted on mahogany. Over the windows are neon signs supplied and installed by Electrolumination, Ltd.

The interior is divided into two rooms, the front half being used for show purposes, and the back, which is divided by a metal panelled wall, will be used for cooking and other demonstrations. The rooms are lined with 20 gauge sheet steel which projects ten inches from the main brick walls, being lined with a metal base wallpaper. They are coved at the top to allow for concealed lighting. One hundred 60-W lamps are used in a range of four colours, red, white, blue and green, and switching is so arranged that any one colour, or blend of colours, may be used. The internal woodwork is black and finished off in "Staybrite" steel beading. The lighting pendants for main lighting are of attractive design and were supplied by Berry's Electric, Ltd. A counter has been provided for the collection of electricity accounts and shelves are arranged in the false walls, while in the wall dividing the showroom and demonstration room are two showcases for the display of fittings and appliances.

The demonstration room is similarly equipped to the showroom, but has a platform for cooking demonstrations. The platform is equipped with a sink, draining board and a five-gallon "Heatrae" water heater. A canopy over the platform has been arranged so that fumes from cooking may be drawn out through an air duct. Ventilation for the two rooms is by means of an intake vent on one side with a duct at floor level, and ventilators in "Staybrite" steel, while on the opposite side is an air duct to take the foul air out through an air brick. The steel walls in both rooms have been cut away for inset-type fires to be installed.

The shop-fitting contractors were Messrs. Mattocks & Son, while all the electrical work, with the exception of the neon signs, was carried out by the Corporation Electricity Department under the supervision of Mr. A. E. McKenzie, the borough electrical engineer and manager. The showroom manager is Mr. D. Chambers.

Telephone Development in the London Area

THE annual statement of progress shows that there are now 244 exchanges in the London area, namely, seventy-two automatic, 162 manual, four trunk, two toll, and four tandem. At the end of 1933 the number of direct exchange lines in use was 477,000, an increase of 14,000, or 3 per cent. Telephones increased by 33,000 to 820,000 and the number of calls grew to nearly 800 millions, an increase of about 7 per cent. The average number of calls originated weekly rose by a million to 15.3 millions.

The introduction of the voice-frequency keysending method of junction working whereby operators at manual exchanges can reach subscribers connected to automatic exchanges without the intervention of a second operator was completed during the summer, a total of 6,000 junctions having been transferred to this method of working. A further development of this system has been introduced between the Putney and Flaxman exchanges, which enables an operator in a manual exchange to obtain direct connection with any subscriber on an automatic or manual exchange within a ten-mile radius from Oxford Circus.

Among the new automatic exchanges which were opened during the year, "Advance" and "Arnold" incorporate new features known as the bypath and common control systems respectively, and at the "Livingstone" exchange there has been installed a new high-speed motor-driven uniselector switch.

Many of the public telegraph lines between London and the large cities of the north and midlands have been replaced by "voice-frequency channels" operated over telephone trunks associated at each centre with specially designed generators producing a.c. of eighteen different frequencies.

The teleprinter service has been considerably extended; 105 private wires equipped were in use between London and other centres, the longest circuit being between London and Dundee. The "Telex" service, which utilises the teleprinter over the ordinary local and trunk telephone system, increased in the London area to eighty-nine stations.

The overseas and ship-to-shore radio-telephone services were extended and Albania is the only European country to which telephone service from London is not yet available. The number of overseas calls increased by 11 per cent. to 657,000. The total number of inland trunk calls originated in the London area was approximately 3,450,000 (as compared with 3,230,000 in 1932).

The number of incoming phonograms reached a total of 2,605,000, a considerable increase over the previous year, but there was a decline in the number of messages dictated to subscribers from 1,200,000 to 1,176,000, due to several large subscribers availing themselves of the "Telex" service for the delivery of telegrams. The number of foreign phonograms handled, 734,000, was about the same as that for the previous year.

Ten automatic exchanges were opened during 1933. There are now fifty-nine automatic exchanges within a ten-mile radius from Oxford Circus with equipment for over 270,000 exchange lines, of which approximately 185,000 are actually working, and further automatic and manual exchanges are under way.

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

Coal Contracts at Poplar

It was stated in the report of the General Purposes Committee presented to the Poplar Borough Council on January 25th that the District Auditor's interim report on the subject of Poplar Electricity Department coal supplies which was placed in the hands of the Public Prosecutor in December had been submitted by the latter to counsel for advice. No comment was made when the Committee's report was reached. This stated: "We beg to report that on receipt of the interim statutory report of the District Auditor in connection with the extraordinary audit of accounts which is now in progress a special meeting of this Committee was convened on the 21st ultimo, and the Town Clerk was given instructions in the matter. We have now received a report of the Town Clerk, that as directed by the Committee he attended on the Director of Public Prosecutions on December 22nd and submitted to him the Auditor's report, with the request that if in his opinion there was any ground in the report for action on his part he should undertake such action. On telephonic inquiry of the Public Prosecutor, the Town Clerk was informed that the report had been submitted to counsel for advice and that the Director hoped to be able to communicate his decision to the Council shortly. Immediately on receipt of the communication we have directed the chairman to call a special meeting of the Committee."

New Electricity Showrooms at Dumfries

The accompanying illustrations show the new showrooms of the Dumfries Electricity Department, which are to be opened on Thursday next. They are situated in the High Street, Dumfries, and occupy part of an island site. As the pictures show, a comprehensive display has been arranged, particularly of domestic electrical appliances. In sending us the photographs, Mr. A. E. Roots, the electrical engineer and manager, states that he has been able to persuade the Council to exercise selling powers in addition to adopting hire and hire-purchase schemes, and he is confident that the showrooms and the attractive schemes, coupled with low domestic tariffs, will do very much to develop to a greater extent the demand for electricity for household purposes.

The new showrooms of the Dumfries Electricity Department which are being inaugurated next week

Electrical Publicity at Morecambe

Mr. P. Clegg, borough electrical engineer of Morecambe and Heysham, has sent us a handbook entitled "Electricity in Morecambe and Heysham," which the Electricity Department has prepared. Ten thousand copies are being printed, and one will be given to each householder in the Department's area of supply, whether an electricity consumer or not. The booklet deals particularly with the local electricity supply, its service and its charges, and, in addition, the advantages of electrical domestic appliances in the home are put forward, while particulars are also given of the Electricity Department's hire-purchase schemes. Mr. Clegg points out that the handbook represents a definite step in a campaign of educative publicity which the Department is at present pursuing, and its purpose is to supplement the newspaper advertising and to overcome that final barrier which too often stands between the supply authority and the prospective user of electricity on a proper scale.

Australian Duties on Generators

At the inquiry by the Australian Tariff Board into the duties on dynamo-electric machinery, Mr. I. V. Robinson, of B.E.A.M.A., said there was ample room for both Australian and British manufacturers of electrical equipment in the Australian market. Up to the time of the 1932 inquiries the Australian market had been practically closed against the importation of electrical machinery and apparatus from the United Kingdom. He suggested that the Board should disregard the argument that no change should be made lest the Australian manufacturers' output should be reduced, as the Ottawa Conference had agreed that there would be a benefit from the freer exchange of those commodities which each portion of the Empire could best produce. If the spirit of the Ottawa Agreement were implemented thoroughly, United Kingdom manufacturers would obtain a fair share of the business offering without reducing the output of Australian manufacturers. There was an enormous amount of electrical development still to be undertaken in Australia.

A Lighting Exhibition in Northampton

An exhibition of modern methods of lighting with lectures on various aspects of the subject and free advice from experts on illumination problems was given in the Northampton Electric Light Co.'s demonstration room from Monday to Thursday this week. The exhibition was arranged by the Lighting Service Bureau of E.L.M.A., and the possibilities of floodlighting were shown by the use of projectors on the roof of the demonstration van.

A French Radio Amalgamation

An amalgamation has recently been effected between the Syndicat des Constructeurs Radio-Electriciens Français and the Association des Constructeurs Français de Radio-Electricité, the name of the new joint body being the Syndicat des Constructeurs Radio-Electriciens Français.

An Unusual Inquiry

A Ministry of Health inquiry was held at Bolton, on January 25th, into an application by Mr. J. Grimshaw, electrical factor, for sanction to the conversion of premises into a shop in order to develop a radio business. The Corporation opposed the request under the Town Planning Act. A section of residents also opposed the application. The applicant said he was closely interested in wireless and television, and had been restricted through the electrical interference of the Corporation tram service. He agreed that there were electrical stores a third of a mile away, but considered that there was need for a shop in Church Road. For the Corporation it was stated this was a residential area. The Ministry will give its decision in due course.

Domestic Electric Science

A new school of domestic electrical science was opened on Monday at Imperial Court, Basil Street, Knightsbridge, S.W.3, by Margaret Lady Moir, O.B.E. The objects are to train pupils in electrical housecraft, for posts as demonstrators and saleswomen, also as housekeepers for public institutions. It is being run by the London School of Electrical Domestic Science, Ltd., particulars of the registration of which appeared in the ELECTRICAL REVIEW for January 12th. Miss H. M. M. Minoprio is the principal. A syllabus has been issued giving particulars of fees, &c. A picture taken at the opening ceremony appears on page 159.

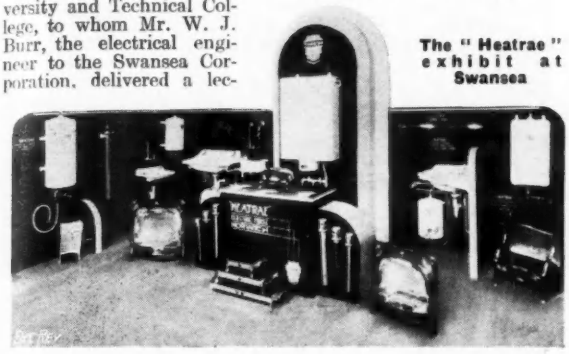
A New Philips Factory

Philips Lamps, Ltd., are erecting their third large factory building at Mitcham. On January 12th the son of the works manager laid the first stone of the new works, which will give

employment to approximately 1,000 people. Many innovations will be included in the equipment of this factory which will tend still further to improve efficiency and general working conditions.

The Swansea Electrical Exhibition

An electrical exhibition organised by the Swansea Electricity Department in co-operation with the British Electrical Development Association was opened on January 24th. A visit has been paid during the week by students of Swansea University and Technical College, to whom Mr. W. J. Burr, the electrical engineer to the Swansea Corporation, delivered a lecture on the Tir John power station and its possibilities. One of the interesting features of the exhibition is a model of the Tir John station lent by the International Combustion Co. The Electrical Association for Women has an inquiry bureau where its literature is displayed. In the Riding School adjoining the main building a model electric bungalow, one of the largest ever built for demonstration purposes, has attracted large crowds. The Marconiphone Co. is participating, while a popular exhibit was a "robot" constructed by Mr. Harry May.



The "Heatrae" exhibit at Swansea

The stands are well arranged; that occupied by the British Thomson-Houston Co. is devoted to a "Mazda" display. On the stand of Callender's Cable and Construction Co., Ltd., is a large show-case containing over a hundred types of rubber-insulated cables, together with wiring accessories. The General Electric Co., Ltd., gives prominence to its medium-size cookers, which are employed by the Swansea Corporation for its hire-purchase scheme. The Jackson Electric Stove Co. shows its new "No. 91 J" cooker, and a complete range of the "90" series of domestic cookers. Santon, Ltd., exhibit thermal storage heaters from 1½ gallons upward, and hair-dressers' equipment. Electric Fires, Ltd., have a comprehensive selection of their water heaters. Other exhibitors were Siemens Electric Lamps & Supplies, Ltd., Burnley Components, Ltd., Johnson & Phillips, Ltd., Falk, Stadelmann & Co., Ltd., Hailwood & Ackroyd, Ltd., Ferranti, Ltd., Berry's Electric, Ltd., the Singer Sewing Machine Co., Beatty Bros., the Westward Electric Co., Morgan Bros., British National Electrics, Ltd., Belling & Co., the Hotpoint Electric Appliance Co., Ltd., the Simplex Electric Co., Ltd., and the Revo Electric Co., Ltd.

During the week lectures were delivered by Mr. J. W. Howells on "Industrial Lighting," and by Mr. E. M. Sawyer on "How to Light the Modern Shop," both being well attended. The exhibition closes to-morrow (Saturday).

Social Events

The annual staff dinner of the British Institute of Engineering Technology and the British Tutorial Institutes was held on January 25th at the Restaurant Frascati, Prof. A. M. Low, the principal, presiding. In proposing the toast of the Institutes, Mr. P. Leach referred to their growth which was due to the go-a-head policy of the board and the co-operation between the directors and the staff. In 1930, their first year, the staff numbered thirty, while to-day there were over 100.

The electrical department of the new showrooms of Messrs. John Norton & Son, which have recently been opened in Sheffield

Mr. J. J. Cleaver, director and advertisement manager, in responding, said they had enrolled 1,041 more students during the past year than in the preceding year, which was itself a record one. The total number of students in 1933 was 12,617, and the total since the formation of the Institutes 46,700. Since 1930 nearly half a million people had written to them for advice. Dealing with the Engineering Institute, he said that of fifty-four students who sat for the A.M.Inst.C.E. examinations, fifty-three passed, while for the past two years they showed 100 per cent. success in the A.M.I.Mech.E. examinations. Regarding the A.M.I.E.E. examinations 25 per cent. of the students who entered were members of their Institute, and of the forty-six students who sat for the examinations, forty-three had passed. Dr. W. H. Steavenson proposed the health of the ladies and Miss R. Rutter responded. The chairman's health was proposed by Mr. H. Hill. The evening was concluded with dancing.

Over 200 members and friends attended the annual social of Blackpool and Fylde Electrical Contractors' Association, on January 23rd, the Mayor and Mayoress also attending. Mr. J. L. Schofield (president) presided. Mr. C. Furness, electrical engineer to Blackpool Corporation, said he believed the time was coming when they would have to have a showroom in Blackpool. It would not compete with the local contractors but would demonstrate all the latest electrical developments. It was the aim of the undertaking to raise the consumption of electricity in the town to 600 kWh per head. Mr. G. Ollier said the Association had always worked in unison with the Corporation in electrical matters and Mr. Furness had always been fair in his dealings. He thanked him on behalf of the Association.

The Dramatic Society of the General Electric Co., Ltd., will present "Baa Baa Black Sheep," a farce by Ian Hay, at the Fortune Theatre on March 19th and 20th. The net proceeds will be given to the funds of the Infants' Hospital, Westminster.

A topical lamp display which is attracting considerable attention in the window of the Edison Swan Electric Co., Charing Cross Road, W.C.

Mr. C. T. Allan, assistant manager, responding to the principal toast at the third annual dinner of the South Wales Electric Power Co., at Pontypridd on January 27th, stated that thirty-five miles of h.p. mains and twenty-five miles of l.p. mains were erected during the past year. The company had put into operation fifty-one sub-stations in 1933, totalling 20,000 kVA. and the output had risen from 90 million to 120 million kWh, an increase of 33⅓ per cent. Since the Shropshire company had joined them the output had increased by 66 per cent. Mr. Roper, J.P., the resident engineer, who presided, expressed regret at the unavoidable absence of Mr. J. T. H. Legge, managing director of the company.

Trade Announcements

Messrs. Aerialite, Ltd., of Manchester, are carrying stocks of their products at their new depôt at 5, St. George's Avenue, Aldermanbury, London, E.C.2 (telephone: Metropolitan 0181); they have also opened a branch at 16, Handyside's Arcade, Percy Street, Newcastle-on-Tyne.

The Ray Engineering Co., Ltd., of Waterdale Works, Southmead, Bristol, has been appointed to represent Messrs. Wm. Sanders & Co. in Bristol and South-west England. Mr. C. E. Sanders, of Cardiff, has ceased to represent the company's interests in South Wales.

Mr. Stanley Lee, electrical contractor, has recently opened new premises in Bancroft, Hitchin, Herts.

The telephone number of the Colton Electric Equipment Co. has been changed to "Canonbury 1068."

Recent Contracts

The Mersey Tunnel Joint Committee has placed a contract for visibility apparatus with Radiovisor Parent, Ltd. This apparatus is for the purpose of automatically observing the visibility in the Mersey Tunnel and recording it at the central control room.

In our issue of December 19th we briefly recorded the con-

tract placed with Messrs. Bruce Peebles & Co., Ltd., for twenty-three rectifier equipments for the Eastbourne-Lewes-Hastings and Sevenoaks electrification extensions of the Southern Railway Co. The company informs us that this contract, representing 57,500 kW of rectifiers, is the largest of its kind ever placed in Great Britain, and follows the order Messrs. Bruce Peebles received in co-operation with the Brown-Boveri Co. for eighteen rectifier equipments for the London-Brighton-West Worthing extension of the Southern Railway which was opened in January, 1933. The contract embraces twenty-three Peebles-Brown Boveri steel cylinder-type mercury-arc rectifiers with main and auxiliary transformers, recooler equipments, control panels and accessories. Each rectifier will be designed for a normal d.c. output of 2,500 kW at 660 V and overloads up to 8,000 kW. The main transformers will be of the oil-immersed self-cooled type designed to operate on the h.p. side at 33,000 V, three-phase, 50-cycles, and the secondary windings will be double six-phase connected, there being twelve anodes on each rectifier. Each equipment will be completely automatic in its operation once the main circuits have been operated by remote control.

The Sunbeam Motor Car Co., Ltd., has been notified by its Natal agents that the Durban municipal authorities are placing an order for a fleet of eleven "Sunbeam" four-wheel trolley-bus chassis to be fitted with double-deck bodies.

Among a number of orders recently placed with Messrs. Mirrlees, Bickerton & Day, Ltd., is one for a six-cylinder 330-b.h.p. engine, driving a 225-kW Brush alternator for the Loughborough College. Orders from India include a five-cylinder, 655-b.h.p. engine driving a 275-kW generator for the Madura Electric Supply Co., and two 334-b.h.p. engines for driving 180-kW G.E.C. generators for the Raichur power station, Hyderabad State. Orders have also been received from Ceylon and Australia, while the Barbados Electric Supply Corporation has placed an order for a six-cylinder. 450-b.h.p. engine to drive a 300-kW G.E.C. generator, this being the sixth engine installed in the Barbados station.

Italian Electrical Imports

The imports of electrical machinery, apparatus, and cognate material into Italy during the ten months ended with October last attained a value of £1,445,466, as compared with £1,901,633 in the corresponding ten months of 1933. There was also a decline during the same period in the exports of similar material from Italy, from £1,256,516 to £594,316.

For Sale

The West Central Merchandise Mart will sell by auction on February 7th at the Warehouse, Torrens Street, Islington, N., electrical motor engineers' stock.

The Normanton U.D.C. has for disposal one 100-kVA Brush transformer.

(See our classified advertisements.)

The Electrical Contractors' Dinner

In our last issue we reproduced (on page 129) some photographs which we took at last week's Electrical Contractors' Association dinner. The first one showed Mr. J. Orringe, the president, with Margaret Lady Moir, but the inscription read "The President and Mrs. Orringe," an error for which we tender our apologies.

A "Magnet" Torch Cut-out

The General Electric Co., Ltd., has prepared a new and arresting coloured cut-out illustrating the complete new range of "Magnet" bakelite electric torches. The cut-out is stoutly constructed and is 17 in. high and 12 in. wide. Printed in varied colours and illustrating each torch in its own colour, this cut-out for window or counter display is well designed to create interest.

A "Magnet" torch sales aid

Works Visit

A party of about twenty-five members of the Aldershot Junior Section of the Institution of Post Office Electrical Engineers visited the works of the Alton Battery Co., Ltd., on January 27th, and were conducted through the various departments by Mr. W. R. Montgomery, director and general manager, who explained the many phases in the production of storage batteries. After an interval for tea a description illustrated by lantern slides of batteries in telephone exchanges was given by Mr. Montgomery. A photograph of the party is reproduced on p. 175.

An Up-to-date Cinema

The accompanying illustration shows the interior of the Commodore Cinema, Orpington, which has recently been completed. The whole of the conduits, cables, switchgear, charging board, telephones and accessories, together with the outside floodlighting and interior decorative fittings, were supplied by Messrs. Falk, Stadelmann & Co., Ltd., while the main switchboard was supplied and erected by Electrical Installations, Ltd. The stage equipment, dimmer board, spotlight and neon lighting were manufactured by the Strand Electric and Engineering Co., the battery for emergency lighting being supplied by the D.P. Battery Co., Ltd.

The interior of the Commodore Cinema, Orpington

Price of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, ETC.	Price, January 31st.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£40	—
a Ammonia, Muriate (large crystal) ... ,,	£38	—
a Borax ... ... ,,	£17	—
a Copper, Sulphate ... ... ,,	£19 15s.	—
a Potash Chlorate ... ... per lb.	3¾d. to 4¼d.	—
a ,, Perchlorate ... ... ,,	6d.	—
a Shellac T.N. ... ... per cwt.	£3	—
a Sulphur Commercial ... ... per ton	£11	—
a ,, Roll ... ... ,,	£11	—
a Soda Chlorate ... ... per lb.	3¼d. to 3¾d.	—
a ,, Crystals ... ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... ... per lb.	4d. nett.	—
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£100 to £105	—
b ,, Wire ... ... per lb.	1/1 to 1/9	—
b ,, Sheet and Foil ... ... ,,	1/2 to 2/9	—
p Babbits Metal and Anti-friction Metals.—		
Grade I ... ... per ton net	£203	£2 dec.
Grade II ... ... ,,	£140	—
Grade III ... ... ,,	£68	—
c Brass (rolled metal 2" to 12" basis) per lb.	7d.	—
c ,, Tubes (solid drawn) ... ... ,,	9d. to 9¼d.	—
c ,, Wire, basis ... ... ,,	7¼d.	—
c Copper Tubes (solid drawn) ... ,,	10d.	—
g ,, Bars (best selected) ... per ton	£62	—
g ,, Sheet ... ... ,,		—
g ,, Rod ... ... ,,		—
g ,, (Electrolytic) Bars ... ... ,,	£37 5s.	£1 15s. inc.
g ,, ,, Sheets ... ,,	£36 10s. to £37 10s.	—
d ,, ,, Wire Rods ... ,,	£42 15s.	£2 5s. inc.
d ,, ,, H.C. Wire ... per lb.	7 5/8d.	¼d. inc.
f Ebonite Rod ... ... ,,	1/3 to 1/6	—
f ,, Sheet ... ... ,,	1/3 to 1/6	—
n German Silver Wire ... ... ,,	2/2	—
h Gutta-percha, fine ... ... ,,	nom.	—
h India-rubber, Para fine ... ... ,,	4¼d.	¼d. inc.
i Iron, Pig (Cleveland No. 3) ... per ton	62/6	—
i ,, Wire galv. No. 1, P.O. qual.... ,,	£20	—
g Lead, English Pig ... ... ,,	£13	5s. inc.
g Mercury ... ... per bot.	£9 10s. to £9 15s.	—
c Mica (in original cases) small ... per lb.	6d. to 3/6	—
e ,, ,, medium ... ,,	4/- to 8/-	—
e ,, ,, large ... ,,	8/6 to 17/6 & up	—
p Phosphor Bronze, plain castings ... ,,	1/1	—
p ,, ,, drawn bars & rods ,,	11d.	—
p ,, ,, rolled strip & sheet ,,	11d.	—
p ,, ,, wire ... ... ,,	11¼d.	¼d. inc.
o Platinum ... ... per oz.	£7 15s.	—
d Silicium Bronze Wire ... ... per lb.	8 5/8d.	5/8d. dec.
r Steel, magnet, in bars ... ... ,,	7¾d.	—
n Tin, Block (English) ... ... per ton	£227 5s. to £229 5s.	£1 dec.
g ,, Wire, Nos. 1 to 16 ... ... per lb.	3/5	—

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
j Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.
r W. R. Dennis & Co.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead and rubber, up to the time of going to press, are given in our "Business Notices" under the same heading.

E.C.A. (Bradford Branch)

The Bradford branch of the Electrical Contractors' Association will hold its annual dinner on February 23rd at the Great Northern Victoria Hotel, Bradford. Sir John R. Brooke will be the principal guest, and he will be supported by Mr. J. Orringe (president), Capt. A. W. Brown, Lord Mayor of Bradford, Mr. J. Roles, Bradford city electrical engineer, and Ald. J. W. Longley, chairman of the Electricity Committee. Mr. H. Moss, chairman of the branch, will preside.

Change of Name

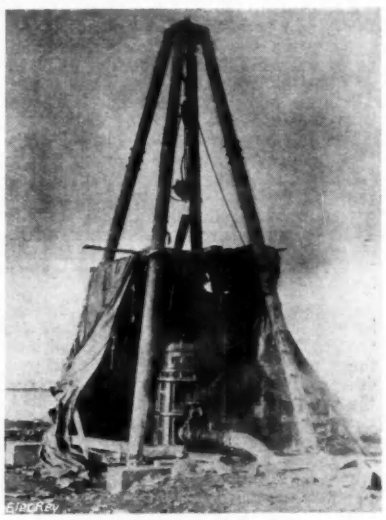
The title of the Ultra Switchgear Co., Ltd., Bright Street, King's Hill, Wednesbury, has been changed to H. D. Switchgear Co., Ltd.

High-speed Diesel Engines

Messrs. Mirrlees Bickerton & Day, Ltd., point out that the slow-speed engine in the background of the picture reproduced on page 115 of our last issue is of 450 b.h.p., not 150 b.h.p. as stated.

Quick Service in Emergency Water Supply

Shortage of water at the paper mill of Messrs. J. A. Weir, Ltd., of Kilbagie, near Alloa, due to the drought, demanded emergency measures. On December 29th the Harland Engineering Co., Ltd., was commissioned to supply, erect, and set to work a borehole pumping plant, to deliver one million gallons of water a day from a disused colliery shaft half a mile from the mill, on condition that the plant should be running by 10 p.m. on January 7th. The job was ready by 3 p.m. on the specified date waiting for power supply, and running commenced at 4 o'clock, though the New Year holidays intervened, representing a works shut-down of five days—half the time allowed. The pump delivers 700 g.p.m. at 290 ft. hd., and is situated 240 ft. below the surface. It is driven by an 85-h.p. vertical squirrel cage motor. Duplicate filters are installed for providing clean, grit-free water for lubricating the bearings carrying the long vertical driving shaft which runs inside the rising main pipe. As a protection against failure of these bearings an electrical and hydraulic interlock is fitted, arranged to shut down the set in the event of a stoppage of the lubrication water due to a choked filter. There are thirty-three lengths of rising main pipe, internal tube and driving shaft between the motor and the pump. The bulk of the plant was dispatched from the works by January 2nd, transported by road, then across more than a quarter of a mile of soft fields and rough ground to the site; motor lorries, a tractor and horses and carts being employed on this work. Thirty ton sheerlegs had to be erected before installation could commence, and then work was carried on continuously in three shifts by artificial light improvised by acetylene and paraffin flares, automobile headlamps driven by car batteries and stable lamps. The set is now running continuously night and day. The consulting engineers for the work were Messrs. D. Selby Bigge & Co.



An emergency borehole pumping plant

New Catalogues and Lists

Concrete Utilities, Ltd., Ware, Herts.—A catalogue of concrete poles for street lamps.

British Thomson-Houston Co., Ltd., Rugby.—Leaflet on sound amplifying equipment.

A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—Leaflet giving particulars of the new type "PLY/15/50" outdoor circuit-breaker.

O. N. Beck, 11, Queen Victoria Street, E.C.4.—Pamphlet describing an economiser protector.

Holden & Brooke, Ltd., Sirius Works, Manchester, 12.—A leaflet on centrifugal pumps.

Best & Lloyd, Handsworth, Birmingham.—A 55-page catalogue of lighting fittings with effective illustrations.

Drake & Gorham Wholesale, Ltd., 77, Long Acre, W.C.2.—Leaflet describing the "Nolos" cylinder lagging jacket.

Marconiphone Co., Ltd., 210/212, Tottenham Court Road, London, W.1.—A leaflet describing a new battery receiver (No. 285), and a broadsheet of the "Lucerne Special."

Ward & Goldstone, Ltd., Frederick Road, Pendleton, Salford, 6.—A catalogue of "Goltone" bakelite and other electrical accessories. A supplementary list of flexible cords, including the new "Antishoc."

National Gas & Oil Engine Co., Ltd., Ashton-under-Lyne.—A pamphlet describing "Austinlite-National" automatic generating plants.

Philips Lamps, Ltd., 145, Charing Cross Road, W.C.2.—details of the new "Philips" cadmium-yellow lamps for motor vehicles.

Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester, 17.—New and revised leaflets for insertion in the company's control gear, switchgear and meter catalogues.

David Brown & Sons (Huddersfield), Ltd., Park Works, Lockwood, Huddersfield.—Descriptive leaflets dealing with "Radicon" reducers.

Key Engineering Co., Ltd., 4, Queen Victoria Street, E.C.4.—A handy celluloid calendar of waistcoat pocket size, with inch and millimetre rules.

Bullers, Ltd., 6, Laurence Pountney Hill, E.C.4.—A catalogue and price list giving details of special types of insulators, double "J" bolts and brackets for radio relay exchanges.

Edison Swan Electric Co., Ltd., 155, Charing Cross Road, W.C.2.—A descriptive booklet on the "Escura" gas-discharge lamp.

Cambridge Instrument Co., Ltd., 45, Grosvenor Place, S.W.1.—Details of the company's portable CO_2 and temperature outfit.

Company Liquidations

Robert Walker (Factors), Ltd.—Meetings March 2nd at 53, Grey Street, Newcastle-upon-Tyne, to receive an account of the winding-up by the liquidator, Mr. T. Bell.

Essex Auto Manufacturing Co., Ltd.—Winding up voluntarily. Particulars of claims to the liquidator, Mr. R. J. Rayner, 1 & 2, Weston Chambers, Weston Road, Southend-on-Sea, by March 10th.

S. A. Lamplugh, Ltd.—Winding up voluntarily. Liquidator, Mr. P. Russell, 10, Newdegate Street, Nuneaton.

Mego Electrical Co., Ltd.—Meetings February 28th at 5, Finsbury Square, E.C., to receive an account of the winding-up by the liquidator, Mr. D. J. Black.

Bankfoot Power Co., Ltd.—Meeting February 20th at Carliol House, Newcastle-on-Tyne, to receive an account of the winding-up by the liquidator, Mr. N. Merz.

Bankruptcy Proceedings

F. W. Chattaway and **J. A. London,** trading in co-partnership as the Spa Electric & Radio Co., 1, Church Walk, Leamington Spa, electrical and radio engineers.—At the public examination of these debtors held recently at the Shire Hall, Warwick, it was disclosed that the deficiency amounted to £879. Chattaway, said that in September, 1930, he entered into partnership with Mr. London and a third party, each partner contributing £50 capital. In 1931 the third partner withdrew, and the business was continued at Regent Street, until 1932, when it was removed to Church Walk, Leamington. Debtors undertook contracts for the local authorities, and also for house installations. Losses were incurred, and in addition competition in the district was keen. Debtor said that losses were also sustained through stock depreciating. The failure was attributed to lack of capital, heavy overhead expenses, and losses on contracts. The other debtor confirmed the evidence given. The examination was adjourned.

A. E. Douch and **M. G. Willis,** trading as Douch and Willis, Central Radio Service, 109, High Street, Dover, radio and electrical engineers.—The public examination of these debtors was held at the Guildhall, Canterbury, recently. The joint statement of affairs showed liabilities of £336 and a deficiency of 4s. 9d. The debtor, A. E. Douch, stated that during the first year's trading there was a net loss of £20. The business had suffered through competition. The failure was attributed to lack of capital. The hearing was concluded.

A. Clough, 28, Town Street, Horsforth, near Leeds, wireless dealer.—The public examination herein was held at the County Court House, Leeds, recently. The statement of affairs showed an estimated deficiency of £38. Debtor said his failure was due to bad trade, heavy overhead charges, and competition. The examination was adjourned for formal closing.

R. C. Stevens, wireless dealer, The Green, Billingham.—First meeting February 2nd at 80, High Street, Stockton-on-Tees. Public examination February 22nd at the Court House, Stockton-on-Tees.

S. J. Garrod (Electrical Repair & Manufacturing Co.), electrical engineer, 181, St. John Street, E.C.—Last day for receiving proofs for dividend February 6th. Trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.

B. M. Cowper and **L. J. White** (Mac's Radio), electrical engineers and wireless dealers, 497, Bristol Road, Bournbrook, Birmingham.—Last day for receiving proofs for dividend February 7th. Trustee, Mr. C. Hoult, 159, Great Charles Street, Birmingham, Official Receiver.

G. S. Whiston, electrical engineer, 112, West Street, Crewe.—Trustee, Mr. A. T. Eaves, 47, Mosley Street, Manchester, appointed January 22nd.

F. W. C. Hoey, wireless and electrical dealer, 51, Montgomery Road, Chiswick, W.—Trustee, Mr. F. F. Sharles, Salisbury House, London Wall, E.C., released November 13th.

D. Makin, electrical engineer, 48, Dronfield Road, Pendleton, Salford.—Trustee, Mr. F. E. Groome, 4, Norfolk Street, Manchester, released November 29th.

Dissolutions of Partnership

Davis & Burrows, wireless and electrical engineers, 3, Clarence Road, Southend-on-Sea.—Messrs. T. H. Davis and T. Burrows have dissolved partnership. Mr. Davis will attend to debts and carry on the business at 40, London Road, Southend.

Sabel, Walby & Co., manufacturers of scientific instruments, and electrical apparatus and armature winding specialists, 22, Church Street, Deptford, S.E.—Messrs. H. Walby and J. Sabel have dissolved partnership. The business will be carried on by Mr. Walby.

Oxley & Lodge, radio and electrical engineers, Kirkgate and Lowbottoms, Hanging Heaton, Batley.—Messrs. C. Oxley and A. Lodge have dissolved partnership. Mr. Oxley will attend to debts and carry on the business under the style of "Claude Oxley."

Electricity Supply

Lighting, Domestic, Power

Addington (Surrey).—EXTENSIONS.—The County of London Electric Supply Co. is to provide a sub-station and extend mains at a cost of £1,665 to supply the Spring Farm Estate, Addington.

Blackpool.—REDUCED CHARGES.—The Electricity Committee has decided to reduce the charges as from April 1st. The present flat rate of 4d. per kWh for lighting will be reduced to 3½d. The rate for business places and shop-window lighting of 6d. and 2d. per kWh will be reduced on the secondary charge to 1½d. per kWh. The industrial heating tariff of 1d. per kWh on-peak load, and ¾d. per kWh off-peak load, will be reduced to ½d. per kWh for off-peak load.

Brighton.—SALE OF BOILERS.—In order to arrange a uniform figure of 2s. per week for hire and fixed charges for apparatus and current on all the Corporation's housing estates, the Health Committee has offered to purchase from the Electricity Department 184 boilers, now on hire, for £480, on a two-years' purchase. This offer has been accepted.

MAINS EXTENSIONS.—Mains are to be extended at a cost of £1,130.

Croydon.—EXTENSIONS.—The Electricity Committee has prepared a scheme for extensions costing £152,539.

SUPPLY IMPROVEMENT.—The Electricity Committee is to improve the supply to Highfield Hill, Upper Norwood, at a cost of £817, and provide a supply to the Gladeside Estate, Ham Farm, at a cost of £2,509.

Dumfries.—REVISED TARIFF.—The Electricity Committee recommends that the County Council shall rescind as from and after December 31st, 1933, Head IV (power) of the tariff which it adopted on October 12th, 1932, and to substitute new rates and conditions.

Dundee.—STREET LIGHTING.—A striking feature of the new City Square, Dundee, which was formally opened by Prince George on November 30th last, is the illumination provided by the street lighting equipment made by the Revo Electric Co., Ltd. This equipment was specially designed for this installation to give a sufficient degree of illumination and at the same time to harmonise with the architectural features of the Square. Revo "Leicester" lanterns on double-arm decorative brackets are mounted on the company's standards at advantageous points in the Square, and provide brilliant and even illumination for the whole area.

Revo lighting equipment in Dundee City Square

ELECTRICAL TRADING PROPOSAL.—The Town Council has appointed a sub-committee to consider a proposal that the Electricity Department should institute a scheme for the hiring and hire-purchase of electrical apparatus and the wiring of houses.

Enfield.—STREET LIGHTING.—The new installation of "Ediswan Escura" gas-discharge lamps in Church Street, Enfield, which we inspected last week, is the first to have the lamps suspended centrally over the road, and it also gives a rather more natural colour effect than many installations of this kind. The reflectors have been designed specially, and are suspended 25 ft. above the centre of the roadway at intervals of from 40 to 50 yards, giving two-way axial light distribution, with the maximum candle-power at between 75 and 90 deg. from the vertical. Although when the shops are not lighted, the greenish-blue colour of the lamp—almost the same as moonlight—is quite noticeable, one does not observe this when the shops are open, and it certainly has no ill effects upon the goods displayed in the windows, yet it maintains an even illumination of the centre of the road.

Gravesend.—BIG ADVANCE IN ELECTRICITY SOLD.—An increase of no less than 6,599,366 kWh is recorded in the amount of electricity sold by the Electricity Department during the year ended March 31st, 1933, the total sales being 24,955,094 kWh. Mr. C. F. McInnes, the borough electrical engineer, states that 1,940 new consumers were added during 1932-33, bringing the total up to 9,625; approximately 75 per cent. of the buildings in the area are now supplied. The average cost per kWh sold was down to 0.445d., as compared with 0.543d. in 1931-32; revenue advanced by £11,336 to £94,222, and there was a net surplus of £11,478 as compared with £6,812.

CHANGE-OVER.—The Town Council has issued a notice intimating its intention within the next six months to proceed with the change-over from the Pier to Pelham Road.

Hull.—SUB-STATION.—The Electricity Committee is to erect a sub-station in Ellerburn Avenue to meet increased demands on the Endoke Lane Housing Estate.

REVISED TARIFF.—The Electricity Committee has made the following tariff alterations: Domestic tariff—¼d. per kWh to be applied for all electricity consumed in excess of the equivalent of thirty kWh per quarter per £ of rateable value of the residence; wash-boilers—the hiring charges under the existing water-heating scheme to be adjusted so as to reduce the present price of 5s. per quarter to 3s. 6d.; street lighting—the annual rental for a 100-W lamp to be reduced from £3 10s. to £3 7s.

India.—CALCUTTA.—The Calcutta Electric Supply Corporation, Ltd., announces that 190,151,448 kWh of electricity was sold during the year ended December 31st, 1933, as compared with 185,134,324 kWh during 1932.

MADRAS PRESIDENCY.—The Tiruvottiyur Union Board is considering a scheme to supply electricity to Tiruvottiyur, a town with a population of 10,500.

ELECTRIFYING DELHI SUBURBS.—Details of the proposed extension of electricity for lighting and industrial purposes in Delhi and the Punjab are reported in *Indian Engineering*, and it is understood that a start will shortly be made to take power to Mehrauli, Qutab and Houz Khas in Delhi Province. The railway colony at Shakurpur Basti, which is about four miles from Delhi, might also be linked up with the scheme. It is estimated that the development of the Kala Pahar area will cost about Rs. 2 lakhs.

UNITED PROVINCES.—As the hydro-electric power generated by the four power stations on the Ganges Canal project in the United Provinces is being found insufficient for its needs, the question of extending the scheme to meet the growing demand for power is now engaging the serious attention of the Government of the United Provinces, and an expert committee has already been appointed to investigate the matter and advise the Government in that connection. It is understood that the demand has come mostly from the villages, where agriculturists have realised that they can improve their productive capacity by the use of electric power.

Irish Free State.—INQUIRY INTO BOARD'S CHARGES.—At a convention of the Federation of Irish Industries in Dublin it was agreed to that the Minister for Industry and Commerce be requested to hold a public inquiry into the charges for power and lighting by the Electricity Supply Board to the various classes of users, with particular reference to the position of employers engaged in the smaller industries.

Kingston-on-Thames.—TWO-PART TARIFF.—The Town Council is to experiment for a year with a two-part tariff for lighting for business premises, with a fixed annual charge of £1 per 100 W of installed lighting capacity, and a "unit" charge of ¼d. during the summer and ¾d. during the winter. It will depend upon the results whether a similar system will be applied to domestic users. There is to be an all-in flat rate charge of 2½d. per kWh for cinemas and theatres, as an alternative to the existing sliding scale.

Kirkoswald.—SUPPLY INAUGURATED.—A public supply of electricity was inaugurated on January 15th. A supply has also been given to the villages of Stainton and Newbiggin, and Great Salkeld, and Lazonby will shortly be linked up. Electricity is now available in eight villages around Penrith.

Liverpool.—MERSEY TUNNEL.—The Mersey Tunnel Joint Committee has awarded to the Electricity Department control of the tunnel's electrical and mechanical arrangements at £7,000 a year.

London.—FINCHLEY.—The North Metropolitan Electric Power Supply Co. recently sent a letter to the Corporation with reference to the number of accidents to its cables caused by road contractors, which, it stated, had become much more frequent since mechanical excavators had been brought into general use. It pointed out that when its property was damaged it made a claim on the parties responsible for the cost of the repairs, but that, from its point of view, this was by no means the most serious aspect of the case; further, that damage to its cables usually meant an interruption of supply to a district. The Committee recommends that in future a clause be inserted in contracts to the effect that it is the duty of a contractor to ascertain the position of cables from the companies concerned, so as to prevent damage to them as far as possible.

HACKNEY.—The Electricity Committee has adopted a report of the electrical engineer upon the additional plant necessary for the supply of energy to the auxiliary plant at Millfields Road, and for increasing the capacity of the Millfields Road sub-station. The engineer is of opinion that provision should be made without delay for another 1,500-kW convertor at the Millfields Road sub-station. This set would be available not only to deal with the increasing outside d.c. supply demand of the network surrounding the works, but also to act as the standby to the existing motor-generator sets dealing with the works auxiliary supplies. The total estimated cost, including cables, is £4,850.

The Electricity Committee is to provide a supply to the Lower Clapton Road Housing Estate at a cost of £1,620.

HAMMERSMITH.—The Electricity Committee has obtained sanction to a loan of £8,981 for sub-stations and equipment. An application has also been received to provide at Latymer Road, Hammersmith Road, rising mains of sufficient capacity to afford cooking supplies to each of the 360 flats (in addition to lighting, heating, &c.) at an estimated cost of £1,300. The Committee recommends that, on the understanding that the owners provide the requisite sub-mains and wire each of the 360 flats for electric cooking (in addition to wiring for lighting, heating, &c.), the Council shall make a contribution of £1,000 towards the cost of the necessary rising mains.

The Electricity Committee recommends that on and from April 1st, 1934, the charge for public lighting of the borough shall be as follows: Fixed charge—£4 per kW of maximum demand per annum, based on the demand during November and December; running charge—0.45d. per kWh, subject to cost-of-coal adjustment.

METROPOLITAN WATER BOARD.—The Board is to replace machinery at the Rye Common pumping station by electrical plant costing £7,500, and has voted £15,000 for the purchase of two sets of portable oil-electric pumping plant.

POPLAR.—The Electricity Committee has suggested the following revised tariffs: Council's flats—1s. 6d. per week, to include cooker wiring, cooker and radiator, the charge to be collected with the rent; charge for electricity—0.6d. per kWh. Where cookers are not installed, the existing rate is to apply. Private house consumers—1s. per week and 0.6d. per kWh (to include cooker and wiring) or 20 kWh for a shilling through separate prepayment meters, provided that the consumer uses 250 kWh per quarter for cooking. For consumers providing their own cookers and wiring the tariff is to be 0.6d. per kWh, plus 2s. 6d. a quarter meter rent. In the event of the adoption of these tariffs, and the scheme meeting with success, a considerable increase will have to be made to the l.p. distributing mains, and the borough electrical engineer proposes to proceed with this work, bearing in mind that there might be a possible change-over to alternating current in the future.

Mill Hill.—SUB-STATION.—The Hendon Electric Supply Co., Ltd., is to erect a sub-station in Wise Lane, Mill Hill.

Montrose (Angus).—STAND-BY PLANT.—The Town Council is to install stand-by plant at the waterworks costing £950.

Northern Ireland.—BANGOR.—The Electricity Board is to lay 1,700 yards of h.p. cable to supply the new pumps at Clandeboy Lake. The Bangor Borough Council is to contribute £300 towards the cost.

BELFAST.—The Belfast Corporation is applying for sanction to alter the supply system of the north-east side of the city in connection with the general change-over from d.c. to a.c.

Nottingham.—ASSISTED-WIRING SCHEME.—The Corporation assisted-wiring scheme has been extended to Arnold, Colwick, Gedling, Holme Pierrepont, Ruddington, Carlton, Edwalton, Hucknall, Radcliffe, South Wilford and West Bridgford. A reduction has also been made in rental charges for electric cookers.

Petworth.—EXTENSIONS REFUSED.—The Rural District Council has decided not to assent to an application by the Mid-Southern Utility Co. for permission to erect l.p. overhead lines at Byworth.

Plymouth.—CABLE EXTENSIONS.—The Electricity Committee has approved cable extensions and links in twelve streets of the city.

Sale.—ACQUISITION OF ALTRINCHAM UNDERTAKING.—An arbitration decision is pending on the terms on which the Sale Urban District Council wil acquire the electricity undertaking of the Altrincham Electric Supply Co., in Ashton-on-Mersey. When Ashton-on-Mersey was amalgamated with Sale in 1930, it was laid down that Sale would have to provide the electricity services which had been provided by the Altrincham Company.

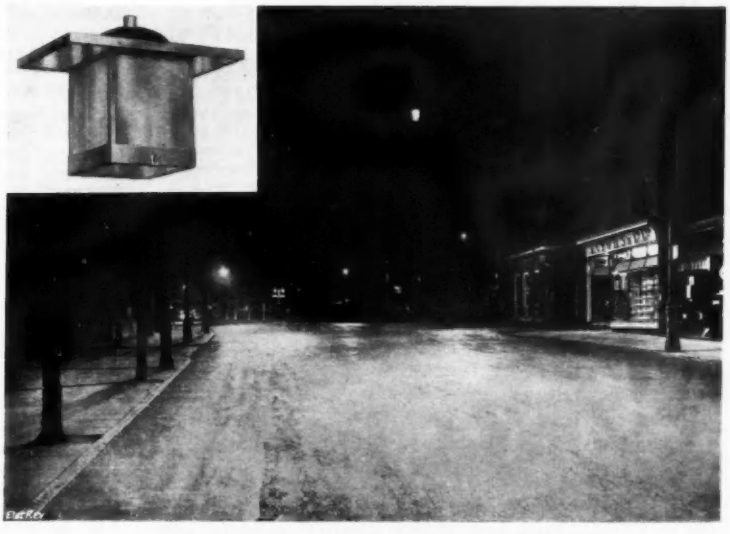
Scotland.—SPECIAL ORDER.—The Scottish Border Electricity Special Order, 1934, made by the Electricity Commissioners, deals with parts of the counties of Berwick, Midlothian, and Roxburgh, which are to be supplied with electricity by the Scottish Southern Electricity Supply Co., Ltd., Edinburgh. Provision is made for the Urban Electric Supply Co. to sell to the Scottish Border Electric Supply Co., if it desires to do so, the undertaking authorised by the Berwick Order of 1900.

LIGHTING INSTALLATIONS.—The Clyde Valley Electrical Power Co. has completed its installation of electric lighting at Strathblane and Blanefield, and the overhead lines are now being taken to Lennoxtown, Torrance of Campsie, and Milton of Campsie.

Southgate.—STREET LIGHTING.—The Highways Committee has conferred with the Wood Green Council with a view to obtaining uniformity in the street lighting of Green Lanes as the latter contemplates changing over from gas to electric lighting by the "Osira" system. The Committee is to consider the advisability of lighting Green Lanes with the system, in the event of the Wood Green Council adopting that method for the portion of Green Lanes in its area and subject to satisfactory terms being agreed by both councils with the North Metropolitan Electric Power Supply Co.

Stokesley (Yorks).—SUPPLIES WANTED.—At the invitation of the Rural District Council, local authorities in the area are to join in a protest to the Electricity Commissioners against the refusal of the North-Eastern Electric Supply Co. to provide electricity to certain villages on the ground of expense.

Swanmore.—SUPPLY UNDER CONSIDERATION.—The West Hants Electricity Co. has informed the Winchester Rural District Council of its intention to give a supply of electricity to Swanmore by overhead lines, and has asked for the Council's consent. The Council has referred the matter to its surveyor for a report.



"Esoura" gaseous discharge lamps at Enfield

Swansea.—PROGRESS AT TIR JOHN.—The Tir John power station is nearing completion. In an interview with our South Wales representative, Mr. J. W. Burr, borough electrical engineer, said that the shafts between the power station and the docks were now complete. They were sunk through very soft ground. The tunnel that connects the shafts at the power house and the dock together is over a mile in length and has been drilled through solid rock at a depth of 300 ft.

Todmorden.—SUB-STATION.—The Electricity Committee is to erect a sub-station in Ramsden Wood Road.

Wallasey.—MAINS RENEWALS.—The Electricity Committee is to prepare a scheme for the renewal of old mains at a cost of £5,000.

WELDING PLANT WANTED.—The Ferries Committee has authorised the manager to obtain tenders for the supply of a portable electric welding machine at an estimated cost of £250.

West Ham.—LOAN.—The Town Council has received sanction to a loan of £50,000 for meters.

West Hartlepool.—ASSISTED-WIRING SCHEME.—The Corporation (borough electrical engineer, Mr. S. Tillotson) has applied for sanction to borrow £5,000 for a new assisted-wiring scheme which is intended to merge the three existing schemes. The new scheme provides for 150 "installation units" per each £ of the cost of installation to be paid for at the rate of 2d. per kWh additional to the scale charge adopted. Consumers may adopt the domestic rate, flat rate or prepayment rate. In order to encourage larger users, the maximum number of "installation units" to be charged at 2d. per kWh may be limited to 250 in any one year.

Wimbledon.—DEVELOPMENTS.—The Electricity Committee is to replace switches at various sub-stations at a cost of £9,000, and has prepared a sub-station programme for the year, involving an expenditure of £15,000. The Electricity Committee is to supplement h.p. trunk mains at a cost of £29,000, and has obtained three sites for transformer stations on the Robinhood Estate, Malden.

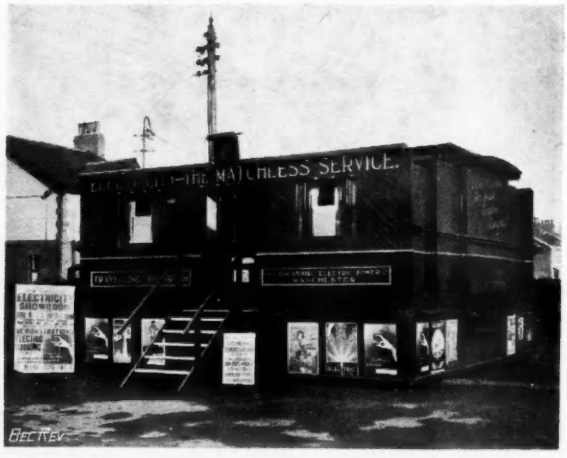
Traction

Birmingham.—TROLLEY-BUSES REPLACE TRAMS.—The electric tramway service on the Coventry Road has been discontinued, and in its place a service of trolley-buses has been provided.

France.—USE OF ELECTRIC VEHICLES.—In the course of a recent paper, M. Chalumeau, the chief engineer of the municipality of Lyons, France, drew attention to the increasing use of electric motor vehicles in that city. Not only has a fleet of accumulator buses been in use in Lyons since 1924, but the municipal council has for some years been using electric tipping vehicles for street cleaning and dust-collecting purposes. One of the latest acquisitions in Lyons is an electric lorry fitted up as a gully emptier and cleaner. The vehicle is equipped with a cylindrical tank capable of holding 330 gallons of sludge. A second new departure in the city is an electric hearse, the controller of which is adapted to provide speeds of from 2 to 17½ m.p.h. Electrically propelled hearses, owing to the low speeds at which they can travel when necessary, are widely used by undertakers in Italy, but made their first appearance in France in the town of Villeurbanne in 1926.

Germany.—WIRELESS RAILWAY SIGNALLING.—A *Reuter* message from Dortmund says that the German railways are to adopt a system of signalling by radio. This is the result of successful experiments recently carried out at Dortmund, one of Germany's biggest railway centres, in which trains were able to keep in touch with signal boxes up to a mile distant. The new system is not to replace existing methods of signalling, but will be additional to them.

Lancashire.—OPPOSITION TO TROLLEY-BUSES.—The Highways Committee of the County Council is to lodge a petition against the application of the St. Helens Corporation for a Provisional Order authorising new trolley-vehicle routes in the Prescot urban district and the Whiston rural district. The Committee states that at the present time the Corporation is running bus service over the route and considers that the present services are adequate, the substitution of trolley-vehicles being



The travelling electrical showroom of the Lancashire Electric Power Co., which is touring the various districts in the company's area of supply

detrimental to the district and to the inhabitants who live on the route in the country area.

London.—TROLLEY-BUS PROPOSALS.—The Wimbledon Town Council is to oppose the London Passenger Transport Board's Bill which seeks powers to provide services of trolley-buses in various districts, but the L.C.C. Highways Committee recommends that the Council should offer no objection to the proposals. The Hammersmith Borough Council has decided to oppose the Bill.

Rhondda.—TRAMWAY ABANDONMENT.—The local company-owned tramway system, which was commenced in 1909, was to be finally shut down yesterday (Thursday) and to-day a motor-omnibus service is to be inaugurated. A Cardiff firm of contractors has been given a contract for the removal of the track (of which there is about twenty-eight miles) and the reinstatement of the roads.

Russia.—ELECTRIFICATION OF THE MURMAN RAILWAY.—A *Reuter's Trade Service* message from Moscow states that preliminary work is proceeding for the electrification of the Murmansk-Kandalaksha line, 188 miles long. In the first place, the Kandalaksha-Apatity-Khibinogorsk section will be electrified and opened for traffic in May.

Sweden.—RAILWAY ELECTRIFICATION.—The plans for the electrification of one of the railways between Sweden and the Norwegian frontier (the line from Gothenburg to the frontier station Kornsjö *via* Mellerud) are now to be carried out, says a *Reuter's Trade Service* message from Stockholm. The two private railway companies, Bergslagernas Järnvägsaktiebolag and Dalslands Järnvägsaktiebolag, have applied to the Government for permission to electrify parts of their systems, and the schemes will no doubt be accepted by the Government, largely with a view to the alleviation of unemployment. The lines in question are those from Kornsjö on the Norwegian frontier to Mellerud (65 km.), and from Mellerud to Gothenburg (123 km.), but Bergslagernas Järnvägsaktiebolag, which owns the latter line, will extend the electrification beyond Mellerud station to the town of Aamaal, 41 km. from Mellerud. The whole electrification scheme of the two private companies thus involves 230 km. The total cost of the projects is estimated at Kr. 12,300,000, including Kr. 5,780,000 for the purchase of electric locomotives and rolling stock. Power will be obtained from the Government-owned power-distribution system, a preliminary agreement having already been concluded with the Waterfalls Board.

Traffic Signals.—The Paddington Highways Committee is to install traffic signals in Westbourne Grove at a cost of £1,225.

The Tynemouth Town Council is considering a proposal to erect traffic-actuated signals at the junction of Broadway and King Edward Road.

Communications

Australia.—TELEPHONES IN VICTORIA.—There are now 111,000 telephone subscribers in the State of Victoria, 65,000 of whom are in the Melbourne area, and 46,000 in the country. There is one telephone for every twelve persons in the State.

WIRELESS FEES BY INSTALMENTS.—Cards have been issued to enable holders of wireless licences to pay their fee by instalments. Each card has forty-eight squares, on each of which postage stamps of the value of sixpence or more may be affixed until the sum of £1 4s. is reached. The card can then be presented at any Post Office, when a licence will be issued.

Ceylon.—TELEPHONE CABLE TO INDIA.—Work on the submarine telephone cable to be laid between Ceylon and India is expected to begin in March. This cable will link Ceylon by telephone not only with India, but with England, America, and most parts of Europe. The cost is being shared equally by the Ceylon and Indian Governments. The cable is being constructed by Messrs. Siemens Brothers & Co., Ltd., of Woolwich, and will be 36 miles long. On the Ceylon side the connecting point will be Talai Mannar, and in India at Rameswaram.

Irish Free State.—WIRELESS BEACON ON THE WEST COAST.—The Irish Lights Commissioners are about to establish, at a cost of about £6,000, a modern wireless beacon to the westward of Aran North, in Galway Bay, west coast of Ireland, for the benefit of trans-oceanic liners calling at Galway. The Galway Harbour Commissioners are supporting the Irish Lights Commissioners in the matter.

Liverpool.—TELEPHONE PROGRESS.—The local P.T. & T. Advisory Committee's annual report shows that in this area (superintending engineer: Mr. T. E. Herbert) during 1933 some 8,740 new telephones were connected, a net increase of 1,274, or 1.6 per cent. Private branch exchanges increased by sixty-seven, and of the 1,327 public call offices over 600 are street kiosks. Two new exchanges were completed, and preliminary work commenced for several others. The trunk exchange was enlarged and equipped with new plant, 65 per cent. of trunk calls now being completed "on demand." Calls totalled 72.5 millions, including 4.5 million trunk calls, an increase of two millions for the year. The submarine cable between the mainland and the Isle of Man has been used for B.B.C. relays and has also had some telegraph circuits superimposed on it without interfering in any way with the transmission of speech and music.

TELEGRAPHY.—The "Telex" service has been extended, and there are now over fifty renters of private teleprinter service in the Liverpool area. Direct telegraph traffic with the Continent shows signs of increasing. The telegraph instrument room at the Liverpool head office has been reconstructed and is now dealing with between 25,000 and 30,000 telegrams per day.

RADIO LICENCES.—The number of broadcast receiving licences in the Liverpool district rose to over 150,000 in 1933, as compared with 133,475 in 1932. There were 120 prosecutions during the year, fines being inflicted in most cases.

London.—BROADCASTING BATTERSEA POWER STATION.—On February 23rd the B.B.C. is to broadcast from the London Regional station a tour of the new Battersea power station. A good deal of experiment will be necessary to make this a success as the effective screening of the apparatus will present serious difficulties.

Sweden.—NEW BRITISH-BUILT STATION.—The Swedish Royal Telegraph Administration has placed a contract with Marconi's Wireless Telegraph Co., Ltd., for a new broadcasting station of the "super-power" class to replace the existing long-wave station at Motala, in accordance with the Swedish Government's decision to improve the broadcasting service in that country. The new station will operate with an unmodulated aerial input of 150 kW, but it is so designed that the aerial input can be increased to 220 kW, if desired, at a later date. The working wave has not yet been decided upon, but the transmitter is capable of operation on any wavelength between 1,000 and 2,000 metres. In many respects the new transmitter will be similar to that which the Marconi Company is now constructing for the B.B.C. station at Droitwich. It can also be utilised, however, as a high-speed telegraph transmitter with a power of 100 kW.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Argentina.—BUENOS AIRES.—February 21st. State Oilfields. Six three-phase, oil immersed, outdoor-type transformers. (A.Y. 12193.)*

Australia.—MELBOURNE.—Post and Telegraph Department. March 13th. Various insulated wires. (A.Y. 12172.)*
March 20th. Telephone protective apparatus of various types. (A.Y. 12186.)*
Bell sets and portable telephones. (A.Y. 12169.)*
March 27th. 150-600 miles of twin 0.048 in. rubber-insulated, braided telephone wire. (A.Y. 12194.)*
City Council. March 12th. Totally enclosed metal-clad switchgear. (A.Y. 12170.)*
March 26th. Supply of three-phase, 6-600-V, metal-clad switchgear, suitable for rupturing 250,000 kVA. (A.Y. 12185.)*
February 26th. City Council Electricity Department. Oscillograph equipment consisting of three vibrators, together with optical viewing and recording accessories. (A.Y. 12191.)*
BRISBANE.—City Council. March 2nd. Two 11,000-V 3-phase metal-clad switchboards. (A.Y. 12184.)*
SYDNEY.—February 28th. New South Wales Department of Railways. One 500-kW rectifier unit. (A.Y. 12182.)* Remote control equipment for a rotary convertor and five enclosing d.c. feeder equipments. (A.Y. 12183.)*
PERTH.—April 19th. Western Australian Government Electricity Supply. Boiler house equipment, one 25,000-kW turbo-alternator and e.h.p. and l.p. switchgear. (See this issue.)

Bedford.—February 12th. Electricity Department. E.h.p., h.p., and l.p. cables, and electric lamps for the year ending March 31st, 1935. (January 26th.)

Belgium.—BRUSSELS.—February 23rd. Municipality. Supply and installation of a 20,000-kW steam turbo-generator. Particulars and plans (125 fr.) from 11, Rue Ste. Catherine.

Blackburn.—February 26th. Electricity Committee. Cable, rubber-insulated wire and consumers' meters for twelve months. (January 19th.)

Cheadle & Gatley.—February 9th. Electricity Department. Various materials during the year ending March 31st, 1935. (January 26th.)
February 12th. One 6,600-V truck cubicle and metering equipment. (January 26th.)

Eastbourne.—February 12th. Electricity Department. E.h.p., h.p., and l.p. cables for twelve months from March 1st next. (See this issue.)

Egypt.—ALEXANDRIA.—February 26th. Ministry of Communications. Cable, switchgear, transformers, hauling winches and motors. (A.Y. 12094.)*

Erith.—February 5th. Electricity Department. H.p. and l.p. switchgear and other apparatus for sub-station equipment. (January 12th.)

Fort William.—February 12th. Town Council. Various works, including electrical, at housing scheme. Specifications, &c., from A. Forrester, Burgh Surveyor. Offers to Town Clerk.

Hamilton.—February 5th. Electricity Department. E.h.p. metal-clad compound switchgear, two 300-kVA transformers, and one kiosk, &c. Specifications, &c., from W. J. Cooper, burgh electrical engineer, Electricity Department, Almada Street. Tenders to Town Clerk.

Harrogate.—February 24th. Electricity Department. Stores for twelve months commencing April 1st, 1934. (January 26th.)

Hastings.—February 20th. Electricity Department. Various materials for the year ending March 31st, 1935. (January 26th.)
February 27th. Electricity Department. Switchgear, cable tiles, concrete covers, copper wire, &c., for twelve months ending March 31st, 1935. (See this issue.)

India.—SIMLA.—February 22nd. Director of Contracts, Army Headquarters. Eighteen electric motors, 1½ to 50 h.p. (January 26th.)

London.—ST. PANCRAS.—February 8th. Borough Council. Traffic signals. (See this issue.)
HAMMERSMITH.—February 28th. General electrical stores, &c., for twelve months. (January 19th.)
STOKE NEWINGTON.—February 23rd. Electricity Department. Meters and l.p. cable (annual contract). (See this issue.)

Manchester.—February 23rd. Electricity Committee. Two complete water-tube boiler units and 33-kV and 6.6-kV switchgear. (See this issue.)

New Zealand.—WELLINGTON.—Posts and Telegraph Department. February 13th. Twenty-four 0-8430-ohm rheostats. (A.Y. 12103.) Fifty miles of tinned copper v.i.r. wire. (A.Y. 12108.)*
February 19th. 1,000 ebonite or bakelite telephone earpieces. (A.Y. 12133.)*
February 19th. Inset transmitters, bakelite mouthpieces and microtelephone plungers for automatic table telephones. (A.Y. 12131.)*
March 13th. 3,000 four-conductor telephone cords. (A.Y. 12149.)*
March 14th. Telephone instrument cords. (A.Y. 12177.)* 2,640 ft. of v.i.r. telephone cable. (A.Y. 12178.)*
March 15th. Twenty-six 2-V 130-Ah cells. (A.Y. 12152.)*
March 27th. Public Works Tenders Board. One set each of 110-kV and 33-kV outdoor switching equipment and steelwork for these. (A.Y. 12180.)*
Public Works Department. April 24th. Four mimic bus panels to control four 110-kV oil circuit-breakers. (A.Y. 12176.)*

Northern Ireland.—BELFAST.—February 5th. L.M. & S. Railway Co. Northern Counties Committee. Stores for twelve months, including telegraph ironwork, wire, electric lamps, &c. Forms, &c., from F. J. Martin, York Road Station (6d. each form); tenders to Secretary.
February 7th. Tramway Committee. Supply of 10 tons (approx.). cadmium-copper trolley wire. Town Clerk.
March 5th. Electricity Board. 33-kV and 11-kV overhead transmission lines, new l.p. distribution systems, and reconstruction of existing l.p. systems. (January 26th.)

Plymouth.—February 8th. Corporation. Meters, time switches, underground cable, transformers, e.h.p. and l.p. switchgear. (January 12th.)

Runwell (ESSEX).—February 28th. East Ham and Southend-on-Sea Joint Visiting Committee. Electrical installation at Mental Hospital. (December 22nd.)

Salford.—February 10th. Electricity Department. Stores, including electric kettles, fires, water heaters, wash boilers, &c. (January 26th.)
February 21st. Electrical stores. (See this issue.)

South Africa.—PRETORIA.—March 2nd. City Council. Turbo-alternator, condensing plant and auxiliaries, boilers and electrically operated crane. (December 22nd.)
February 16th. Government Supplies Board. Telephone switchboards for private branch exchanges. (A.Y. 12165.)* Underground armoured cables, covered wire, copper wire, &c. (A.Y. 12166.)* Six level measuring sets and six audio-frequency oscillators. (A.Y. 12168.)*
JOHANNESBURG.—Railways and Harbours. February 26th. Fog-signalling plant consisting of a Diesel-engine driven d.c. generator, a d.c. motor driven 150-cycle, a.c. generator, and an atmospheric acoustic emitter with accessories. (A.Y. 12174.)*
February 19th. Two-ton electrically driven overhead travelling crane. (A.Y. 12181.)*
CAPETOWN.—February 21st. Electricity Supply Commission. Eighteen oil-immersed transformers for outdoor use. (A.Y. 12192.)*

Southend-on-Sea.—February 8th. Electricity Department. General stores for twelve months. (January 12th.)

Stoke-on-Trent.—February 7th. Electricity Department. E.h.p. switchgear and transformers for twelve months. (January 19th.)

Swansea.—February 8th. Electricity Department. Sulphur and dust extraction plant, lime plant and ash plant for Tir John power station. (January 5th.)
February 8th. Two motor-driven reciprocating air compressors and receivers for Tir John power station. (January 26th.)
February 16th. Stores for twelve months from April 1st, 1934. (January 26th.)

Torquay.—February 5th. Corporation. Twelve months' supply, from April 1st, of electric lamps, &c. Tenders on forms provided to be delivered to the Borough Engineer.

Uruguay.—MONTEVIDEO.—March 21st. State Electricity Supply and Telephones Administration. H.p. and l.p. and telephone armoured cables. (A.Y. 12189.)*

Worcester.—February 17th. Electricity Department. Meters, cables, transformers, &c., for twelve months ending March 31st, 1935. (See this issue.)

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* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Blackburn.—Public Assistance Committee. Accepted. Rewiring of offices.—T. Blackshaw.

Croydon.—Electricity Committee. Accepted. Construction of reinforced concrete cooling tower and culvert at the power station (£22,147).—Concrete Piling, Ltd. Ash-handling plant (£2,759).—E. Bennis & Co.

Dundee.—Police Committee. Accepted. Heating installation at Central Police Station (£1,427).—J. Combe & Son, Ltd. Electric lighting installation in section of reconstructed building (£227).—Stenson & Co.

Hull.—Education Committee. Accepted. Electrical installation at Hall Road School (£496).—G. M. Kettlewell.
Electricity Committee. Accepted. Erection of depôt in Osborne Street (£9,444).—F. Hall & Sons, Ltd.
Telephones Committee. Accepted. Cable (£259).—British Insulated Cables, Ltd. Insulators (£31).—Bullers, Ltd. Lead-in wire (£74).—Callender's Cable Co., Ltd. P.A.B.X. (£1,272).—Ericsson Telephones, Ltd.

Ilford.—Fire Brigade Committee. Accepted. Five fire alarm boxes with lines, &c. (£280).—Walters Electrical Manufacturing Co., Ltd.

London.—L.C.C. — Central Public Health Committee. Accepted. Automatic cold storage plants at six hospitals (£2,226).—Pulsometer Engineering Co., Ltd.
Housing Committee. Electric lighting, &c., at East Dulwich estate (£2,208).—Buchanan & Curwen, Ltd. Electric lighting, &c., at Honor Oak estate (£1,162).—G. E. Thomas & Co.
HAMMERSMITH.—Electricity Committee. Recommended. Installation of rising mains at Granville Mansions, Shepherd's Bush Green (£66).—G. Goodchild.

Skegness.—Urban District Council. Accepted. Installation of traffic signals (£401).—Automatic Electric Co.

Southgate.—Health Committee. Recommended. Installation of internal automatic telephones at isolation hospital (£150).—North Metropolitan Electric Power Supply Co.

Wallasey.—Baths Committee. Accepted. Amplifying equipment at bathing pool (£320).—Gramophone Co., Ltd.

Notes

Manchester Electro-Harmonic Society

The annual Ladies' Evening of the Manchester Electro-Harmonic Society was held last Saturday at the Manchester Limited Restaurant. A record gathering of 280 members was received by Mr. A. Noel Smith, president. The proceedings took the form of a dinner-dance and cabaret, and once again a thoroughly enjoyable evening was provided. In proposing the toast of the society, the president explained that it was an organisation which provided high-class musical evenings for those engaged in the electrical and allied trades. Although there had been similar societies, he believed this was the only one which remained, the London and Liverpool Electro-Harmonic Societies having gone out of existence. Mr. H. A. Pryor proposed the health of the president. The arrangements were in the hands of Messrs. C. E. Leak (hon. sec.), L. H. Marlor (hon. treasurer) and the Music Committee.

Regenerative Control

Members of the Institution of Electrical Engineers are invited by the Institute of Transport to attend a meeting of the Institute to be held in the I.E.E. Lecture Theatre on February 12th at 5.30 p.m., when a paper on "Regeneration as Applied to Electric Traction," by Mr. G. F. Sinclair, will be read and discussed. Members wishing to take part in the discussion can obtain advance proofs of the paper on application to the Secretary of the Institute, 15, Savoy Street, W.C.

The Diesel Engine Users' Association

The annual dinner of the Diesel Engine Users' Association will be held on February 27th at Pagani's Restaurant, W., when the president, Mr. C. F. Mounsdon, will preside.

Owing to the misplacing of a decimal point in our review of the Association's report last week, repair and renewal costs for Diesel engines were given as 0.284d. per kWh; it is obvious from the context that this should have been 0.0284d.

The Electrical Association for Women

The annual dinner of the Harrogate branch was held on January 24th. Mrs. W. B. Woodhouse, the branch president, was in the chair, and the speakers were Sir John Brooke, the Mayor of Harrogate, Miss C. Haslett, Mr. W. B. Woodhouse, Miss A. K. Hamilton, the Lady Mayoress of Leeds, Major J. Milne, M.P., and Mrs. W. H. Thompson.

The annual dinner of the Halifax branch took place on January 25th, when the guests included the Lord Mayor and Lady Mayoress of Bradford (Capt. and Mrs. A. W. Brown), the Mayor and Mayoress of Halifax (Mr. and Mrs. F. Austin Leach), Mr. Gilbert Gledhill, M.P., Mr. E. A. Mills, Halifax borough electrical engineer, and Mrs. Mills. The speakers were Miss C. Haslett, Lady Fisher-Smith, Mrs. Mills, and the Lady Mayoress of Bradford.

The annual meeting of the Ilkley branch of the Association, held on January 25th, re-elected Lady Watson, of Pool, as president, with Mrs. Gordon Rycroft as vice-president; Miss Lawson as hon. secretary; and Mr. Herbert Sykes, hon. auditor. Miss Caroline Haslett addressed the meeting on the work and progress of the movement.

The Work of the N.P.L.

The normal method of communicating the results of researches at the National Physical Laboratory is by the reading of papers before the appropriate scientific or technical societies, in the proceedings of which they are subsequently published. In response to numerous inquiries received from industrial bodies and individuals who wish to be kept in touch with the work of the Laboratory it is proposed to issue each month a list of such papers. During December the following papers of electrical interest were read: "The Valve-maintained Tuning Fork as a Primary Standard of Frequency," by L. Essen and the late W. D. Dye (Royal Society); "Leakage Phenomena in Ring-type Current Transformers" and "Current Transformer Testing," by A. H. M. Arnold (both I.E.E.); "The Electrical Properties of Sea Water," by R. L. Smith-Rose (Royal Society); "The Lighting of Docks," by S. S. Preston (I.E.S.). Papers published included one on "An Automatic Counting and Timing Mechanism for Testing Electricity Meters," by A. Felton (*Journal of Scientific Instruments*, Vol. 10, No. 12).

Electric and Magnetic Units

In the brief article on this subject in our issue of January 19th the proposed symbol for magneto-motive force was given as "script R"; this should have been "script F."

The Carbon Microphone

In a paper contributed to the *Journal* of the Institution of Electrical Engineers, Mr. D. N. Truscott describes experiments upon a granular carbon microphone at known amplitudes of vibration of the diaphragm. The output is shown to be determined by six variables: Amplitude of vibration; frequency of vibration; resistance of microphone; temperature of microphone; feed current of microphone; and arrangement of granules. The effect of the last is much less than has been supposed, being about ±10 per cent. at 50 mA, and increasing with the feed current. The curves obtained are constant for long periods and represent characteristics by which the microphones may be compared. An experiment upon the conductivity/separation relation for two granules (indirectly supported by recent theoretical work in wave mechanics) leads to the hypothesis that the action of the granules is a simple make-and-break effect at each contact. A bibliography of other workers in this field is included.

Fatality

"Accidental death" was the verdict at an inquest held at Nelson on January 26th on Herman B. Aldersley (39), Irvine Street, who received a fatal electric shock through stepping from a bath on the flex of an electric radiator. It was stated the radiator and flex used had been lying in an outhouse for six months. Mr. G. Baldwick, mains assistant in the Corporation Electricity Department, said that a section of the insulation had perished. Aldersley must have trodden on the flex and received a shock while he had one foot in the bath.

Small Greenhouse Heating

In the article "Small Greenhouse Heating," by Mr. H. Church in our last issue (first paragraph), it was stated that the system required "the absolute minimum of temperature." The last word should have been "attention."

Appointments Vacant

Distribution engineer for Grimsby Corporation Electricity Department.

Electrical engineer for Middlesex County Architect's Department.

(See our classified advertisements.)

Forthcoming Events

Faraday House Old Students' Association.—Friday, February 2nd. Midland Hotel, St. Pancras. 7.30 p.m. Annual Dinner-Dance.

Electrical Trades Commercial Travellers' Association.—Friday, February 2nd. Criterion Restaurant, W.1. 6.30 p.m. for 7 p.m. Annual Dinner.

Institution of Mining Engineers.—Friday, February 2nd. Burlington House, W.1. 11.15 a.m. Annual General Meeting.

Institution of Electrical Engineers.—Monday, February 5th. Institution, London. 7 p.m. Informal meeting. Discussion on "The Future Trend of Grid-Controlled Rectifiers." Opened by Mr. J. E. Calverley. Thursday, February 8th. Grosvenor House, W.1. 7 for 7.30 p.m. Annual Dinner. (*North-Eastern Students' Section*).—Friday, February 2nd. Armstrong College, Newcastle-on-Tyne. 7.15 p.m. Students' Lecture. "Domestic Electrical Apparatus from an Engineering Point of View." Mr. F. H. Clough. (*North Midland Centre*).—Friday, February 2nd. Royal Victoria Hotel, Sheffield. 7.30 p.m. Engineers' Dance. Tuesday, February 6th. Hotel Metropole, Leeds. 7 p.m. "The Heating of Domestic Pendant Lamp Fittings and their Connecting Leads." Messrs. P. D. Morgan, H. G. Taylor and W. Lethersich. (*Meter and Instrument Section*).—Friday, February 2nd. Institution, London. 7 p.m. "Grid Metering." Mr. J. Henderson. (*North-Western Students' Section*).—Saturday, February 3rd. 2.30 p.m. Visit to works of Messrs. Ferguson Pailin, Ltd., Manchester. (*Hampshire Sub-Centre*).—Monday, February 5th. Kimbell's Café, Southsea. 7.30 p.m. Conversazione and Dance. (*North-Western Centre*).—Tuesday, February 6th. Engineers' Club, Manchester. 7 p.m. "The Measurement of Noise, with special reference to Engineering Noise Problems." Messrs. B. A. G. Churcher, A. J. King and H. Davies. (*East Midland Sub-Centre*).—Tuesday, February 6th. College, Loughborough. 6.45 p.m. "Metering." Mr. W. Lawson. (*Wireless Section*).—Wednesday, February 7th. Institution, London. 5 p.m. "A Velocity-Modulation Television System." Messrs. L. H. Bedford and O. S. Puckle. (*Scottish Students' Section*).—Wednesday, February 7th. Heriot Watt College, Edinburgh. 7.15 p.m. Students' Lecture by Mr. F. H. Clough. (*Dundee Sub-Centre*).—Thursday, February 8th. University College, Dundee. 7.30 p.m. "Centrifugal Pumps." Mr. H. Collingswood.

Association of Mining Electrical Engineers.—(*London Branch*).—Tuesday, February 6th. Junior Institution of Engineers, London. 6.30 p.m. "Electrical Lay-out for Mechanised Coal Winning." Mr. H. Taylor. (*South Wales Branch*).—Saturday, February 10th. South Wales Institute of Engineers, Cardiff. 6 p.m. "Mercury Arc Rectifiers." Mr. H. Rissik.

Electrical Association for Women.—Tuesday, February 6th. G.E.C. Research Laboratories, Wembley. 3.30 p.m. "New Street-lighting." Mr. J. M. Waldram.

Institute of Plastics Industry.—Wednesday, February 7th. Windsor Castle Hotel, S.W.1. 7.30 p.m. "British Standard Specifications with Particular Reference to Electrical Mouldings." Mr. W. D. Owen.

Electrical Engineers' Ball.—Friday, February 9th. Grosvenor House, W.

Junior Institution of Engineers.—Friday, February 9th. Institution, London. 7.30 p.m. "Thunder Storms, Magnetic Storms, and Wireless Transmission." Prof. E. V. Appleton.

Salford Technical and Engineering Association.—Saturday, February 10th. Royal Technical College, Salford. 7 p.m. "Electric Arc Welding." Mr. W. E. Quine.

Makers' Names Wanted

UTEX panel switch.
ACME electric wash-boiler.
A.B.C. lamp lock.
WINCHESTER electric torches.
DRODUIT conduit system.
LIGHTNING ice-cream freezer.
Ebonite sheets for ALCONUM cells.

Our Personal Column

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

Mr. **Bernard Sleath,** the author of the article on "Two-part Tariff Metering" on page 151, was educated at Warwick Grammar School and was articled to the Midland Electric Light & Power Co., Ltd. He joined the London sales staff of the General Electric Co., Ltd., and was later sales engineer with Messrs. Chamberlain & Hookham, Ltd., Birmingham. Since 1929 he has been joint sales manager, with Mr. L. C. Sharp, of Venner Time Switches, Ltd.

Mr. **J. Bastian,** Southern Area representative of Messrs. Berry, Wiggins & Co., Ltd., has been away from business since Christmas owing to illness, but expects to resume his normal activities very shortly.

Mr. **A. J. Priddle** has been appointed to the Associated Equipment Co., Ltd., in succession to the late **Mr. D. E. Batty,** taking the title of traction engineer. In effect, this means that Mr. Priddle will, in future, be concerned with the development of trolley-buses, an increasing phase of the company's activities. Mr. Priddle has had many years' sound experience in the electrical traction field, having joined the Metropolitan Tramways in 1918. At the end of three years he was given a position in the laboratory and inspection department of the Underground group of tramways, which he held for a similar period; and in 1924 was appointed superintendent of the core and armature winding departments of the London United Tramways, Ltd. After four years in this post he was made assistant rolling stock superintendent of the Metropolitan Tramways, and in February, 1931, he was allotted an important post in connection with the trolley-bus developments of the tramway system. For three years he has acted as liaison officer between the operating company and the vehicle manufacturers, has supervised the training of drivers, conductors and inside staff, and planned and controlled the maintenance work on the new vehicles.

Mr. A. J. Priddle

Mr. **Parkhill,** Postmaster-General of Australia, is to attend the International Postal Congress at Cairo. After the conference he will visit this country and will discuss with officials of the British Post Office matters affecting communications between Australia and the United Kingdom. He is expected to remain in London several months as the principal representative of the Commonwealth, while Mr. Bruce visits Australia.

Mr. **H. A. Howie,** M.I.E.E., engineer and manager of the Walsall Corporation Electric Supply Department, is about to resign his position on the ground of ill-health. He has spent forty years in public service. He was formerly second in command at Sheffield under Mr. S. E. Fedden, and had two generating stations under his control. During his service at Walsall the generating station was transferred to the West Midlands Joint Electricity Authority, and, with Councillor Tibbits, he has represented Walsall on the Authority.

Mr. C. R. Belling and Mr. C. L. Arnold at Wengen. Mr. Belling says the snapshot was taken at the end of an exhaustive day's inquiry into the merits of "radiant heat"

Mr. W. W. Parkinson, one of the oldest officials of Blackpool Corporation Electricity Department, is about to retire, after forty years' service. He has held the post of works superintendent for many years, and has been connected with the undertaking since its commencement in 1893.

Mr. F. Campion, formerly with Messrs. Crompton Parkinson, Ltd., and the English Electric Co., Ltd., has joined Messrs. Johnson & Phillips, Ltd., as manager of their switchgear and transformer department.

The following changes have been made in the personnel of Electrical & Engineering Products, Ltd.: **Mr. P. N. Rand,** M.I.E.E., who joined the company in May last as joint managing director, has been appointed chairman of the company, and **Mr. J. A. Goodwin,** who for many years represented the General Electric Co., Ltd., has been appointed the company's manager in Yorkshire with offices at 7/8, North British and Mercantile Buildings, East Parade, Leeds. **Mr. Alan Williams,** M.I.E.E., is operating in the South of England and in the Eastern Counties. **Mr. P. P. Wheelwright,** M.I.E.E., is also associated with the company, and correspondence for him or Mr. Alan Williams should be addressed to the head offices at Westminster.

[*Elliott & Fry*

Mr. P. N. Rand

Mr. J. A. Johnson, who has been nominated for the presidency of the American Institute of Electrical Engineers, is the chief electrical engineer of the Buffalo, Niagara and Eastern Power Corporation, Buffalo, N.Y.

Mr. Samuel Insull recently applied for an extension of his permit to stay in Greece, which was to expire on January 31st, on the ground of ill-health. Later reports state that doctors appointed by the Greek Government to examine him have agreed that he is fit to travel under medical supervision.

We are glad to learn that **Mr. W. C. P. Tapper,** consulting engineer and manager of the Stepney Borough Council's electricity undertaking, has sufficiently recovered from his recent illness to return to his duties.

Mr. Theodore Stevens is to take over the duties of hon. secretary to the Overhead Lines Association in succession to Mr. E. A. Boyd, who has resigned the hon. secretaryship. A vote of thanks was passed to Mr. Boyd at the last meeting of the Association for his services. Mr. Stevens was the original secretary of the Association, and held office for several years.

Members of the Aldershot Junior Section of the Institution of Post Office Electrical Engineers at the Alton Battery Co.'s works. **(See page 168)**

Mr. Alan Wright has been appointed sole sales representative for Messrs. Geo. Bray & Co., Ltd., for their electrical water-heating products in London, the South of England, East Anglia, and the South Midlands. He will also represent the company in the industrial heating field.

We regret to learn from the *Industrial Australian and Mining Standard* that **Mr. W. H. Alabaster** is resigning from the position of city electrical engineer of Melbourne owing to severe illness. Mr. Alabaster has been an officer of the Melbourne City Council for about thirty years.

Mr. H. A. S. Gothard, consulting engineer, has removed to Kimberley House, 14-17, Holborn Viaduct, E.C.1.

Sir Arnold B. Gridley has joined the board of the Southern Areas Electric Corporation, Ltd.

Major-Gen. Sir Frederick Hugh Sykes, P.C., has been elected a director of Callender's Cable & Construction Co., Ltd., and of the Anchor Cable Co., Ltd.

Obituary

Mr. S. Hinchcliffe.—The death is announced, at the age of sixty-four years, of Mr. Samuel Hinchcliffe, of Oldham, who was for many years in business there as an electrical engineer. He was the pioneer of inter-department mill telephones, and had installed over 800 in Oldham.

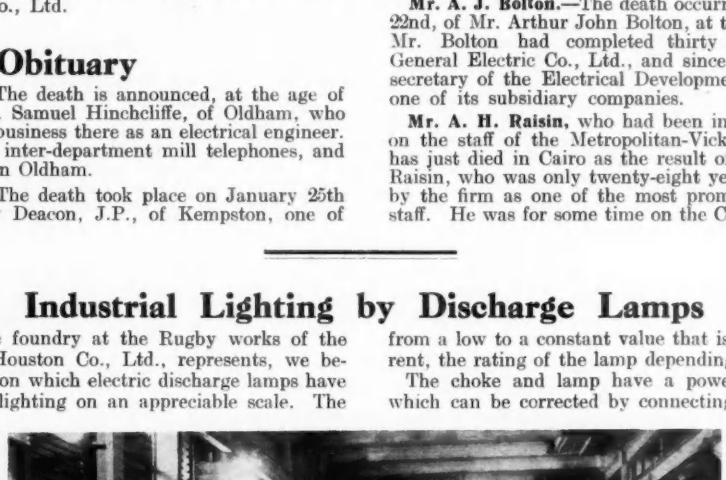
Mr. H. S. Deacon.—The death took place on January 25th of Mr. Horace Stanley Deacon, J.P., of Kempston, one of the founders of Cryselco, Ltd. He went to that town about forty years ago, and retired from active commercial life in 1922. He served for a long period on the Urban District Council, of which he became chairman.

Mr. A. J. Bolton.—The death occurred suddenly, on January 22nd, of Mr. Arthur John Bolton, at the age of fifty-five years. Mr. Bolton had completed thirty years' service with the General Electric Co., Ltd., and since 1930 had been assistant secretary of the Electrical Development and Securities Trust, one of its subsidiary companies.

Mr. A. H. Raisin, who had been in Egypt for about a year on the staff of the Metropolitan-Vickers Electrical Co., Ltd., has just died in Cairo as the result of an electric shock. Mr. Raisin, who was only twenty-eight years of age, was regarded by the firm as one of the most promising young men on its staff. He was for some time on the Company's Russian staff.

Industrial Lighting by Discharge Lamps

THE lighting of the foundry at the Rugby works of the British Thomson-Houston Co., Ltd., represents, we believe, the first occasion on which electric discharge lamps have been used for interior lighting on an appreciable scale. The two main bays, each 240 ft. by 32 ft., are lighted by twenty-four 400-W "Mazda-Mercra" lamps mounted on stanchions at 17½ ft. above ground and 40 ft. apart. The minimum intensity of illumination is 3 ft.-candles and the maximum 4.25, although the floor is black and the walls have little reflective value. The consumption is 0.65 W per sq. ft.



Gaseous discharge lamp lighting at the B.T.-H. foundry, Rugby. (Inset: The "Muron" lantern)

The "Mazda-Mercra" lamps have wire cathodes inserted at each end of an inner glass tube, which is separated from an outer glass envelope by an evacuated space. The wire cathodes give a high electronic emission when incandescent. A wire spiral connected to the lower cathode adjusts the potential gradient along the tube at starting. On switching on conduction takes place through inlet gas at a pressure of about 4 mm. As the mercury present vaporises the lamp voltage rises from a low to a constant value that is independent of the current, the rating of the lamp depending on the choke setting.

The choke and lamp have a power factor of 0.6 lagging, which can be corrected by connecting a condenser across the line. Red rays are present in the spectrum, but in insufficient quantities to render this colour faithfully, and it appears as brownish red, but other colours are reproduced satisfactorily.

The "Muron" lantern has been developed especially for the illumination of industrial workshops. Its rectangular main body is built from angular metal strips which hold the "Stippolyte" glazing. Sloping outwards from the sides and bottom are three vitreous enamelled reflectors; a fourth forms the base of the canopy. The lower part of the lantern is hinged to allow removal of the lamp. Light is controlled by diffusers and reflectors only and is thrown downward, forward, and on both sides. Our illustration shows that the new method of illumination is very effective.

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

British Radiodyne, Ltd.—Private company. Registered January 23rd. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of, agents for and dealers in, radio apparatus and accessories, electrical and scientific apparatus or appliances, &c. The subscribers are: G. Richardson, 180, North Road, Southend-on-Sea; and Mrs. N. A. Duncan. 52, George Lane, South Woodford, E.18. Solicitors: Wilson & Blew, 10, Coleman Street, E.C.2.

Frinton & Walton Radio, Ltd.—Private company. Registered January 25th. Capital, £600 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in radio sets, valves, gramophones and radio gramophones, television sets, &c. The first directors are: H. W. Franklin, "Hathersage," Old Road, Frinton-on-Sea; and T. H. Levett, "Jeanette," St. Mary's Road, Frinton-on-Sea. Registered office: Station Corner, Pole Barn Lane, Frinton-on-Sea.

J. C. Miller, Ltd.—Private company. Registered in Edinburgh January 23rd. Capital, £300 in £1 shares. Objects: To carry on the business of manufacturers, commission agents, electricians, dealers in electrical and radio supplies, &c. The directors are: J. C. Miller, 17, Balldric Road, Knightswood, Glasgow. Registered office: 123, New City Road, Glasgow.

C. F. Jacoby, Ltd.—Private company. Registered January 27th. Capital, £1,100 in 1,000 5 per cent. preference and 100 ordinary shares of £1 each. Objects: To acquire the business of wireless dealers and engineers carried on by C. F. H. Jacoby and M. G. Hill at 8, Cottenham Parade, Raynes Park, S.W.20. The directors are: C. F. H. Jacoby, 8, Cottenham Parade, Raynes Park (chairman); and M. G. Hill, 129, Coombe Lane, Wimbledon, S.W.20. Solicitors: Buckeridge & Braune, 3/4, Clement's Inn, W.C.

Cornish Accessories Co., Ltd.—Private company. Registered January 11th. Capital, £3,500 in £1 shares (1,000 7 per cent. cumulative preference and 2,500 ordinary). Objects: To carry on the business of manufacturers, repairers, hirers and agents for the sale of wireless accessories, appliances and goods, accumulators, batteries, dynamos, motors, valves, wires, lamps and electrical accessories, financiers of hire-purchase transactions, &c. The first directors are: F. W. A. Williams, "Trenaie," Kenwyn, Cornwall, and two others. Secretary: F. W. A. Williams. Registered office: 12, Lemon Quay, Truro, Cornwall.

Hessle Relay Service, Ltd.—Private company. Registered January 26th. Capital, £2,000. Objects: To erect and maintain wireless signal stations, &c. The subscribers are: W. S. Wheldon, 3, Lake View, Hull; and E. W. Suddaby, 143, Westcott Street, Hull. Secretary: T. G. Burton. Registered office: 27, Scale Lane, Hull.

Sweetmore's Relay Services, Ltd.—Private company. Registered January 24th. Capital, £3,500 in £1 shares. Objects: To construct and maintain wireless signal stations, to receive, transmit and relay radio programmes, &c. The directors are: J. Sweetmore, 26, Spencer Street, Burnley, and four others. Registered office: 26, Spencer Street, Burnley.

Returns of Electrical Companies

North-Eastern Electric Supply Co., Ltd.—Particulars have been filed of debenture stock to secure £2,500,000, and any further stock issued under the trust deed. The stock was authorised on October 25th, 1933, and is covered by a trust deed dated December 30th, 1933. The amount of the present issue is £2,500,000. The principal amount of all three-and-a-half per cent. consolidated debenture stock issued and outstanding, together with £2,300,000 five per cent. consolidated debenture stock, is never to exceed the paid-up share capital for the time being. Property charged: the electric lighting and power undertakings of the company and its other undertakings and assets, present and future, including uncalled capital. Trustees: Law Debenture Corporation, Ltd.

Mid-Lincolnshire Electric Supply Co., Ltd.—The nominal capital has been increased by the addition of £100,000 beyond the registered capital of £100,000. The additional capital is divided into 100,000 6½ per cent. cumulative convertible preference shares of £1 each. The new shares were allotted to the British & International Utilities, Ltd., on January 16th, 1934, as consideration for the extinction of a loan of £100,000 due to them from the company.

Broadcast Relay Service, Ltd.—Issue on March 16th, 1933, of £10,000 debentures, part of a series already registered. (Particulars of issue filed January 20th, 1934.) Satisfaction to the extent of £25,000 (the remaining £25,000 having been cancelled) on June 27th, 1933, of debentures authorised November 9th, 1932, and registered November 17th, 1932. (Notice filed January 20th, 1934.)

Aerialite, Ltd.—The nominal capital has been increased by the addition of £6,000 beyond the registered capital of £100. The additional capital is divided into 3,000 7 per cent. cumulative redeemable preference and 3,000 ordinary shares of £1.

C. E. Greenwood, Ltd.—Particulars filed of debentures not exceeding £5,000 authorised December 4th, 1933, charged on the company's property, including uncalled capital, the amount of the present issue being £1,500.

Radio Chassis, Ltd.—The nominal capital has been increased by the addition of £1,250 beyond the registered capital of £100. The additional capital is divided into 1,250 5 per cent. cumulative preference shares of £1 each.

Supra Electra Motors, Ltd.—Particulars filed of £5,000 debentures, authorised December 27th, 1933, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £1,000.

Pioneer Private Telephone Co., Ltd.—Debenture, dated January 5th, 1934, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd.

Vactite Wire Company (1919), Ltd.—Satisfaction in full on January 10th, 1934, of memorandum of deposit of deeds dated June 26th, 1931, and registered July 3rd, 1931. (According to the register of mortgages, the memorandum of deposit registered July 3rd, 1931, originally secured all moneys due to bank.)

Midland Counties Electric Supply Co., Ltd.—Satisfaction to the extent of £375,000 on January 13th, 1934, of 5 per cent. debenture stock covered by trust deeds dated February 26th, 1914, November 15th, 1915, and April 14th, 1919, and registered March 14th, 1914, December 2nd, 1915, and April 17th, 1919, respectively.

Wireless Trading Association, Ltd.—Satisfaction to the extent of £350 on December 29th, 1933, of debentures authorised September 29th, 1932, and registered October 7th, 1932.

Harmony Electrix, Ltd.—The nominal capital has been increased by the addition of £900 in £1 ordinary shares beyond the registered capital of £100.

Neon Hire and Supply Co., Ltd.—The nominal capital has been increased by the addition of £500 beyond the registered capital of £1,000. The additional capital is divided into 10,000 shares of 1s. each.

Wycombe Electrical Supplies, Ltd.—Particulars filed of debentures not exceeding £600 authorised by resolutions of January 1st and 2nd, 1934, charged on the company's property, including uncalled capital, the amount of the present issue being £600.

Radio Supplies and Service Co. (Bristol), Ltd.—Particulars filed of debentures, not exceeding £105, authorised January 11th, 1934, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £105.

Scott Insulated Wire Co., Ltd.—Satisfaction to the extent of £2,000 on January 6th, 1934, of debenture dated January 22nd, 1923, and registered January 25th, 1923.

Express Magneto (Repairs) and Electrical Co., Ltd.—Capital, £2,000 in 1,500 cumulative preference and 500 ordinary shares of £1. Return dated August 11th (filed November 1st), 1933. All shares taken up. £2,000 paid. Mortgages and charges, £1,750.

O. S. Choppin & Co., Ltd.—Capital, £1,000 in £1 shares. Return dated July 14th, 1933 (filed January 12th, 1934). 702 shares taken up. £2 paid. £700 considered as paid. Mortgages and charges, nil.

Belshaw & Co., Ltd.—G. F. R. Bagueley, 32, Bullingham Mansions, Church Street, W.8, was appointed receiver and manager on January 18th, 1934, under powers contained in debentures dated June 11th, 1930.

Public Utilities (Electric), Ltd.—Capital, £25,000 in £1 shares. Return dated June 28th, 1933. 12,500 shares taken up. £12,500 paid. Mortgages and charges, nil.

Mersey Cable Works, Ltd.—Capital £40,000 in 10,000 preference and 30,000 ordinary shares of £1 each. Return dated July 11th, 1933. 22,000 ordinary shares taken up. £22,000 paid. Mortgages and charges, £12,500.

Bective Electrical Co., Ltd.—Capital £10,000 in 116 6 per cent. preference and 80 7 per cent. preference shares of £50 and 4,000 ordinary shares of 1s. each. Return dated October 26th, 1933. 114 6 per cent. preference, 64 7 per cent. preference and 4,000 ordinary shares taken up. £9,100 paid. Mortgages and charges, nil.

Associated Construction & Power Co., Ltd.—Capital, £10,000 in £1 shares. Return dated October 13th, 1933. 402 shares taken up. £402 paid. Mortgages and charges, nil.

Paramount Electric & Equipment Co., Ltd.—Capital, £500 in £1 shares. Return dated September 5th, 1933. Six shares taken up. £6 paid. Mortgages and charges, nil.

Wilrose Company (Birmingham), Ltd.—Capital, £100 in £1 shares. Return dated August 25th, 1933. 75 shares taken up. £75 paid. Mortgages and charges, £2,500.

H. P. Electrical Co., Ltd.—Capital, £1,000 in £1 shares. Return dated September 25th, 1933. 654 shares taken up. £654 paid. Mortgages and charges, nil.

George Hill & Co., Ltd.—Capital, £4,000 in £1 shares. Return dated September 20th, 1933. 2,150 shares taken up. £2,150 considered as paid. Mortgages and charges, nil.

City Notes

Westinghouse Brake & Saxby Signal Co., Ltd.—Presiding at the annual meeting held on January 26th, Lord Southborough (chairman) said that the trade embarrassments had continued during the past year, and the loss on the year's trading, both at home and abroad, had been largely due to the reduction in the volume of orders which it had been possible to obtain. Competition had been keen, but they believed that they had obtained their usual proportion of the work available. Their subsidiaries had incurred losses, but there was no need to take a pessimistic view as to their future. Economies had been made in all directions without sacrificing the quality or efficiency of their products. Dealing with the prospects for the coming year, he said that the British railways were again entering on an era of comparative prosperity, and they had reason to know that the railways were actively preparing plans which would involve the purchase of the company's types of manufacture.

The Montreal Light, Heat and Power Consolidated reports net earnings for 1933 of $11,950,000, as compared with $12,774,500 in the previous year. Earnings on the common shares were 170 cents, as compared with 195 cents in 1932. After payment of dividends, a balance of $1,309,500 was added to the capital and surplus account.—*Reuter* (Montreal).

The Shawinigan Water & Power Co. reports a gross revenue of $11,946,000 for 1933, as compared with $12,635,000 in 1932. The net revenue after all charges have been made, but before dividends have been paid, amounts to $1,843,000, as against $2,534,500. The gross revenues from electricity sales were higher during the year, being $10,827,550, against $10,773,500. Miscellaneous revenues were lower.—*Reuter* (Montreal).

Companies Struck off the Register.—The names of the following companies have been struck off the Register and are thereby dissolved:—Electrico, Ltd.; Short Wave Communications Development Co., Ltd.; Singapore Electric Tramways, Ltd.

The City of Buenos Ayres Tramways Co. (1904), Ltd., has announced a final dividend of 1¼ per cent., making 5 per cent. for the year (same).

The Mersey Railway Co. has recommended a dividend of ½ per cent. on the ordinary stock (unchanged).

Stocks and Shares

TUESDAY EVENING.

THE general tendency of Stock Exchange markets remains very firm. Business continues to come spasmodically, as pointed out in last week's REVIEW. The main volume of orders flows through speculative channels. There is being transacted, however, an amount of investment business unusual for this time of the year. The reason for this is that people now look forward to a reduction in the Budget, which, if it were to be made, would have the effect of bringing more capital into purely investment securities—unless, indeed, there should be a departure from the traditional convention, which says that investment prices inevitably give way upon any increase in taxation and move upwards when the national burdens are diminished.

Gilt-edged Stocks

The gilt-edged markets are holding their prices. A rise in War Loan led an advance amongst British Government issues. Whatever sales of stock are made, plenty of buyers are ready to take the securities, with the result that no important changes have occurred in Central Electricity or the senior London Passenger Transport stocks. The "C" stock of the latter authority has gone back a point to 84, apparently on the opposition that is to be offered from certain directions to the Board's Bill. The Board proposes to put a fleet of trolley-buses on the roads, and promises that these shall be of the most up-to-date description. In anticipation of a useful contract being placed with the Associated Equipment Company, A.E.C. shares are a good market at 32s. 6d. Next week the Home Railway companies will start announcements of the final dividends for 1933. The prospect is not regarded with undue optimism, but the traffic returns of recent months give ground for sober hopefulness in respect of the current year.

London Electricity Supply Shares

The weekly quotation in our lists of London electricity supply shares leads to a point which is, for the moment, a

matter of serious consideration. It cannot have escaped notice that the shares of companies such as the Brompton, Charing Cross, Chelsea, London Electric, St. James', and South London are all standing at practically the same level. Variations in the prices are so slight as to render it scarcely worth while, some may think, for the shares to be quoted here week by week. If the price of one company's shares rises or falls by sixpence, so, within a week or two, do the quotations for the others in the same group. The prices are standardised, so to speak, by reference to the 7 per cent. dividend which was paid for 1932 in respect of the ordinary shares in these companies, the yield being £4 1s. 2d. per cent. at 34s. 6d. It is true that speculation flirts with the possibility of the dividends on these companies being increased for the year lately ended. According to certain of the prophets, the final distribution to be announced within the course of the next few weeks may show an increase—a view to which no support has been given here. If the dividends for 1933 prove to be again 7 per cent., the quotations for the various London companies' ordinary shares will be more influenced, during 1934, by the factors that affect gilt-edged securities than by trading prospects. The point for consideration is, therefore, whether these ordinary shares shall be retained week by week, in view of the likelihood that they will vary scarcely at all. As if to answer the doubt, Westminster ordinary shares have to-day, Tuesday, advanced to 35s., at which price the yield, upon the basis of 7 per cent. dividend, is 4 per cent. Allowance for inclusion of the dividends for the second half of the year will make the yield rather more favourable to the investor.

Provincial and Foreign

Shares in the Provincial electricity supply undertakings show a greater flexibility of fluctuation, for every now and then one company or another will make a fresh issue, imparting thereby an additional measure of marketability to the shares of the company concerned. Such new issues will continue to be made, and they will exert a natural influence over prices.

West Gloucestershire preference stock is a point easier at 102½. The ordinary has gone back to 64. In the foreign list, Whitehall Electric preference have further strengthened to a guinea. Atlas ordinary reverted to 9s. after being a trifle better. British Power & Light keep about 20s. 3d.

Dollar Stocks

According to well-informed authorities, the financial position in Canada has taken a turn for the better. It is said that President Roosevelt's policy is having more effect in Canada at the present time than in the United States, in the way of quickening business and of restoring confidence. On the other hand, evidence was recently presented of the acute financial difficulties with which some of the Canadian provinces and municipalities are still struggling. There is, however, a distinct willingness on the part of the speculative investor to regard more favourably than he has done for some time past the outlook for Canadian industrials. Montreal Light & Power shares are better at 37¼, Shawinigan Water have moved up to 21½. British Columbia Power and Power Corporation of Canada shares are improving. The United States industrials are also advantaged to some extent by Mr. Roosevelt's attitude. Amongst the shares popular on both sides of the Atlantic, Electrical & Musical Industries have risen to 19s. 6d. on an impression that the capital is to be cut down with a view to bringing the shares into the dividend-paying list. The price, which last year fell at one time to 7s., has risen, as stated, to within a few pence of 20s.

Cables and Wireless

The A ordinary stock of Cables & Wireless is lower at 25. Interest in the three issues of the combine is at a low ebb. Nothing fresh has transpired concerning the nebulous rumour about a possible amalgamation of communication and radio interests. American Telephone & Telegraph common shares retain their rise to 120. Internationals at 16½ are ½ higher. This week's rise in Great Northern Telegraphs is 25s., lifting the price to 26¼. Globe preference have strengthened to 12½.

Telephone Manufacturing ordinary at 7s. 9d. show a few pence fall; Telephone Rentals keep at 7s. 9d., and Telephone Properties are a trifle off at 20s. 7½d. Anglo-Portuguese Telephone new shares are 3s. 6d. premium; the senior shares have been 27s. 6d. for two or three weeks.

Manufacturing and Equipment

Siemens's ordinary recovered to 22s., at which price shares came on offer. Johnson & Phillips have been a dull market, shares changing hands down to 20s. 4½d. A rise of half-a-crown left Crompton Parkinson ordinary at 25s.; the preference moved down to 31s. 3d. Last week's fall of ninepence in Associated Electrical Industries has been repeated, taking the price to 19s. 9d. Small declines in British Aluminium and in Ferranti preference made the prices 32s. and 26s. 6d. respectively. Enfield Rolling Mills at 32s. 9d. are slightly better. Philip's Incandescent Works at 49s. 9d. have responded sharply to buying from Holland. Reyrolle ordinary at the same price are also harder.

The iron and steel section is quiet; Babcocks show a trifling decline at 43s. 3d. Rubber shares, after a brief bout of activity and strength, turned dullish upon doubts as to whether restriction of output can be brought into operation just yet.

Share List of Electrical Companies

	Nom.	Approx. Dividend. 1931.	1932	Price, Jan. 30.	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	78/9	—	3 16 3
Brompton Ordinary	1	8½	7	34/–	—	4 2 4
Charing Cross Ordinary	1	8½	7	34/6	—	4 1 2
Chelsea	1	8½	7	34/6	—	4 1 2
City of London	1	10	10	35/–	—	4 0 0
Clyde Valley	1	7	7	42/–	—	3 6 8
County of London	1	10½	10½	57/6	—	3 13 0
Edmundson's 7% Pref.	1	7	7	34/–	—	4 2 4
Elec. Dis. Yorkshire	1	9	9	47/6	—	3 16 0
Elec. Supply Corporation	1	11	11	78/9	—	2 15 8
Kensington Ordinary	1	8	7	34/6	—	4 1 2
Lancs Light and Power	1	7	7	37/–	—	3 15 8
London Electric	1	2	7	34/6	—	4 1 2
Metropolitan	1	10	10	55/9	—6d.	3 11 5
Midland Counties	1	7	7	40/–	—	3 10 0
Mid. Elec. Power	1	8	8	45/–	—	3 11 1
North Eastern Electric Ordinary	1	6	6	37/–	—	3 4 10
Do. 7% Pref.	1	7	7	34/6	—	4 1 2
Northampton	1	10	10	55/–	—	3 12 9
Notting Hill 6% Pref.	10	6	6	13¾	—	4 8 11
North Met. Elec. Ordinary	1	—	10	3½	—	3 1 6
Do. do. 6% Pref.	1	6	6	30/–	—	4 0 0
St. James' and Pall Mall	1	8	7	35/–	+6d.	4 0 0
Scottish Power	1	8	8	2½	—	3 15 4
South London	1	8½	7	34/6	—	4 1 2
Westminster Ordinary	1	8½	7	34/6	—	4 1 2
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	21/–	+6d.	7 2 10
Yorkshire Elec.	1	8	8	47/6	—	3 7 3
PUBLIC BOARDS.						
Central Electricity, 1950–70	...Stock	5	5	113	—	4 8 6
Do. 1955–75	... „	5	5	114	—	4 7 6
Do. 1951–73	... „	4½	4½	106	—	4 5 0
Do. 1963–93	... „	—	3½	94½	—	3 14 1
London & Home Counties, 1955–75	„	4½	4½	108	—	4 3 4
London Passenger Transport, A	„	—	4½	116	—	3 17 7
Do. do. B	„	—	5	120½	—½	4 3 0
Do. do. C	„	—	—	84	—1	—
West Midlands Joint Elec. 1948–68	„	—	5	114	—	4 7 6
TELEGRAPH AND TELEPHONES.						
American Tel. & Tel.	$100	9	9	120	—	7 10 0
Anglo-Am. Tel. Pref.	Stock	6	6	114	—	5 5 3
Do. Def.	„	1½	1½	28½	—	5 5 3
Cables & Wireless 5½% Pref.	„	2¾	2¾	73¼	—	3 14 8
Do A 7½% Ord.	„	Nil	Nil	25	—1	—
Do. B. Ord.	„	Nil	Nil	11	—	—
Globe Tel. and T. Ord.	10	Nil	2½	10	—	2 10 0
Do. do. Pref.	10	6	6	12½	+½	4 18 0
Great Northern Tel.	10	20	20	36½	+1½	5 10 4
Marconi-Marine	1	10	7½	31/3	—	4 16 0
Oriental Telephone Ord.	1	12	12	3½	—	*3 16 10
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref.	5	Nil	Nil	2/–	—	—
Do. do. 2nd Pref.	5	Nil	Nil	1/6	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	6	—	—
British Electric Traction Df. Ord.	„	5	5	510	—	—
Do. do. Pref. Ord.	„	8	8	147½	—	5 8 6
Brazil Traction	100	—	—	13½	+½	—
Brit. Columbia Elec. Rly. Pre.	Stock	5	5	100½	—	4 1 6
Mexico Trams, 5% Bonds	—	5	5	22½	—	22 4 4
Mexican Light Common	100	Nil	Nil	8	+2½	—
Do. 7% Pref.	100	7	7	11	—	—
Do. 1st Bonds	—	5	5	45½	—2	10 10 6
Victoria Falls Ord.	1	15	20	5½	—	3 12 9
Yorkshire (West Riding)	1	Nil	Nil	17/–	+6d.	—
MANUFACTURING COMPANIES.						
Assoc. Elec. Ord.	1	4	4	19/9	—9d.	3 18 3
Do. Pref.	1	8	8	31/3	—	5 2 5
Babcock & Wilcox	1	14	9	43/3	—6d.	—
British Aluminium Ord.	1	5	5	32/–	—6d.	3 2 6
British Insulated Ord.	1	15	15	75/–	—	4 0 0
Brush Ord.	Stock	Nil	Nil	42½	—	—
Callender's	1	15	15	65/–	—	4 12 4
Do. 6½% Pref.	1	6½	6½	30/9	—	4 4 6
Crompton Parkinson Ord.	5/–	22½	12½	25/–	+½	—
Do. 8% Pref.	1	8	8	31/3	—⅛	5 2 5
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	6 2 5
Do. 5% Deb.	Stock	5	5	102½	—	4 17 7
Electric Construction	1	Nil	Nil	10/–	—	—
Enfield Cable Ord.	1	25	25	97/6	—	5 2 5
English Electric	1	Nil	Nil	7,6	—	—
Do. do. Pref.	1	Nil	Nil	10/–	—	—
Ever Ready	5/–	35	35	30/3	—	5 15 8
Ferranti Pref.	1	7	7	26/6	—9d.	5 5 9
G.E.C. Pref.	1	6½	6½	30/6	—	4 5 3
Do. Ord.	1	8	8	45/0	—	3 11 1
Henley's	1	30	30	6⅛	—	4 15 6
Do. 4½% Pref.	5	4½	4½	5½	—	4 5 9
India-Rubber Preferred	1	—	—	15/–	—	—
Johnson & Phillips	1	5	5	21/3	—⅛	4 14 1
Siemens Ord.	1	7½	6½	22/–	+⅛	—
Telegraph Construction	£1	Nil	Nil	27/6	—	—

* Dividends paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1932

5697. "Systems for controlling operations by means of sound waves." H. C. Summer, F. J. Taylor, F. Langley and L. H. Pearson. May 27th, 1932. (403935.)

8595. "Feed-back circuits." Hazeltine Corporation. May 28th, 1931. (403964.)

9293. "Control of electric relays by means including electric discharge devices." British Thomson-Houston Co., Ltd. March 31st, 1931. (403987.)

11650. "Process for preparing silicon steel sheets for electrical purposes." American Rolling Mill Co. (May 18th, 1931.) (Addition to 331511.) (403950.)

12536. "Electric clutches." J. Dyson. May 2nd, 1932. (403975.)

14768. "Remote control electromagnetic switches." O. Evans (Stotz-Kontakt Ges.) May 24th, 1932. (403992.)

14878. "Radio telephone systems." Marconi's Wireless Telegraph Co., Ltd., and W. P. Wilson and F. M. G. Murphy. May 25th, 1932. (403940.)

16082. "Portable electric drilling machines." Hardypick, Ltd., and F. W. Hurd. June 7th, 1932. (403996.)

18153. "Arrangement for switching inductive loads on to networks of relatively small capacity." Siemens Schuckertwerke Akt.-Ges. August 15th, 1931. (403958.)

13297. "Coin-operated gas and electricity meters and like mechanism." United Gas Industries, Ltd., E. W. Smith and A. Charles. June 28th, 1932. (404002.)

13720. "Electric condensers." Jarrett, Rainsford & Laughton, Ltd., and G. A. Laughton. July 2nd, 1932. (403947.)

13779. "Directional aerials." Marconi's Wireless Telegraph Co., Ltd., and C. S. Franklin. July 2nd, 1932. (403949.)

13890. "Electronic amplifier valves." Marconi's Wireless Telegraph Co., Ltd., N. M. Russ and G. F. Brett. July 4th, 1932. (403973.)

19104. "Magnetic compositions containing principally iron and cobalt." Electrical Research Products, Inc. August 14th, 1931. (404011.)

19117. "X-ray tube apparatus." W. E. Schall and L. G. Hahn. July 6th, 1932. (404013.)

19123. "Electric signalling systems." Automatic Electric Co., Ltd., and P. F. Gunning. July 6th, 1932. (404014.)

19126. "Multi-range electrical measuring instruments." H. S. Macadie and Automatic Coil Winder and Electrical Equipment Co., Ltd. July 6th, 1932. (404015.)

19132. "Stroboscopic apparatus." British Thomson-Houston Co., Ltd., and C. G. Mayo. July 6th, 1932. (Addition to 312082.) (404016.)

19133. "Supporting bushing insulators, particularly in electric current transformers." British Thomson-Houston Co., Ltd., and W. S. Adams. July 6th, 1932. (404017.)

19156. "Television." Electrical & Musical Industries, Ltd., and C. O. Browne. July 6th, 1932. (404020.)

19273. "Radio and other carrier-wave transmitters." Marconi's Wireless Telegraph Co., Ltd., and H. J. H. Wassell. July 7th, 1932. (404024.)

19274. "Modulation arrangements employing fluid-cooled thermionic valves." Marconi's Wireless Telegraph Co., Ltd., and T. H. Price. July 7th, 1932. (404025.)

19369. "Insulating compositions for submarine electric signalling cables." Electrical Research Products, Inc. September 30th, 1931. (404027.)

19384. "Thermionic valve apparatus." H. A. Ewen. July 8th, 1932. (404029.)

20337. "Methods of synchronising electric motors." International General Electric Co., Inc. July 16th, 1931. (404047.)

21236. "Rotary electric switches." C. A. Turner. July 27th, 1932. (404055.)

21424. "Electric contact devices." British Insulated Cables, Ltd., A. Harper and R. H. Atherton. July 29th, 1932. (404057.)

21554. "Electrical couplings, switches and the like." Hardypick, Ltd., and F. W. Hurd. July 30th, 1932. (404058.)

22392. "Electric discharge devices." M-O Valve Co., Ltd., and K. A. Macfadyen. August 10th, 1932. (404063.)

23044. "Controller box for gas or electric street lamp columns." Blakewater Foundry, Ltd., T. A. Aspden, and J. Bond. May 6th, 1933. (404058.)

23311. "Electric safety cut-outs." British Thomson-Houston Co., Ltd. August 21st, 1931. (404069.)

25381. "Electric welding of rivets, especially those used in knitting machine needles." G. Fuchs and H. Spath. September 12th, 1932. (404086.)

25947. "Wireless aerials and poles or posts therefor." C. Manning. September 17th, 1932. (404091.)

26691. "Self-starting synchronous motors." R. C. Graseby. September 26th, 1932. (404094.)

27416. "Electric discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. October 3rd, 1931. (404101.)

28473. "Means for operating the brush gear of a.c. commutator motors." British Thomson-Houston Co., Ltd., and H. F. Jefferson. October 12th, 1932. (404105.)

28613. "Electric signalling systems." W. H. Dean. October 13th, 1932. (Cognate application 15609/33.) (404106.)

29079. "Brackets for supporting electric insulators." Bayliss, Jones & Bayliss, Ltd., and J. Ingham. October 18th, 1932. (404109.)

29716. "Electric discharge tubes." International General Electric Co., Inc. October 22nd, 1931. (404111.)

30557. "Electric vacuum switches." British Thomson-Houston Co., Ltd. October 29th, 1931. (404112.)

30895. "Electric contact devices." Siemens Bros. & Co., Ltd., and H. E. Humphries. November 2nd, 1932. (404113.)

31974. "Electrodes or welding rods for use in electric arc welding." Quasi-Arc Co., Ltd., and A. P. Strohmenger. November 11th, 1932. (Cognate application 3012/33.) (404122.)

33944. "Electrically heated melting pot for type-bar making and other machines." Le Matin and W. B. Smits. November 30th, 1931. (Cognate application 33945/32.) (404131.)

37016. "Apparatus for applying lead sheaths to electric cables." W. Brown. December 31st, 1932. (404137.)

1933

765. "Wave-signalling methods and apparatus." Radio Research Laboratories, Inc. October 25th, 1932. (404140.)

3079. "Means for suspending electric light bowls or shades." G. & J. Swingler, Ltd., and E. Swingler. February 1st, 1933. (404148.)

4427. "Synchronous electric motors." G. R. Shepherd (Westinghouse Electric & Manufacturing Co.). February 13th, 1933. (404155.)

6076. "Electric fan motors." E. Hoogland. February 28th, 1933. (404162.)

7978. "Systems and apparatus for landing aircraft by the use of electromagnetic waves." C. Lorenz Akt.-Ges. March 31st, 1932. (404167.)

8390. "Thermionic cathode for electric discharge devices." International General Electric Co., Inc. March 19th, 1932. (404169.)

8642. "Process for gettering electric discharge valves." H. Von Hartel. March 22nd, 1932. (404170.)

10816. "Brush lifting gear for electric motors." M. W. Woods, Ltd., and M. I. Greenwood. April 11th, 1933. (404178.)

11130. "Momentary contact switches for electric mine firing devices." K. Schaffler-Glossl (trading as Schaffler & Co.). May 30th, 1932. (Cognate application 11131/33.) (404181.)

11867. "Piezo-electric oscillators or resonators." C. Zeiss. April 28th, 1932. (404185.)

12771. "Remote control systems for electric motors." British Thomson-Houston Co., Ltd. May 4th, 1932. (404188.)

16031. "Reception of ultra-short electric waves." Naamlooze Vennootschap Machinerieen-En Apparaten Fabrieken. June 2nd. 1932. (404207.)

18782. "Electric control and amplifying systems." H. Baron (A. S. Fitzgerald). July 1st, 1932. (Cognate application 34292/32.) (Divided application on 18677/32.) (404034.)

19012. "Electric signalling lamp." P. Grunwald. July 11th. 1932. (404218.)

19650. "Electric incandescent lamps." General Electric Co., Ltd. July 28th, 1932. (404222.)

20180. "Wireless-receiving systems connecting aerials to distributing systems." Naamlooze Vennootschap Philips Gloeilampenfabrieken. July 16th, 1932. (404225.)

21054. "Operation of rectifiers in parallel." British Thomson-Houston Co., Ltd. July 26th. 1932. (404232.)

21174. "Electric transformers." British Thomson-Houston Co., Ltd. July 28th, 1932. (404233.)

25077. "Electrical cables." W. Brown. September 11th, 1933. (404245.)

31263 "Method of producing firmly adherent galvanic deposits on aluminium and its alloys." Siemens & Halske Akt.-Ges. February 15th, 1933. (Addition to 385067.) (404251.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from January 24th:—

Aquvator. No. 545259. Class 9. Mercury vapour lamps for use in the sterilisation of bath water.—Kelvin, Bottomley & Baird, Ltd., 16-20, Cambridge Street, Glasgow, C.2.

Irgonite. No. 545753. Class 40. Material in sheet or slab form made principally of india-rubber or gutta-percha, electrical insulators made therefrom, and india-rubber solution. No. 545754. Class 50. Synthetic resin and synthetically produced carbon compounds of rubber substitutes, electrical insulating substances produced from carbon compounds and sold in the form of liquids or pastes, and electrical insulating oils and resins.—Société J. R. Geigy, Basle, Switzerland. (British representatives: Henry Imrie & Co., 72-74, Cannon Street, E.C.4.)

B.S.S. for Boiler Tubes

FOLLOWING the issue in July last year of the cold drawn weldless steel boiler and superheater tube specification (B.S.S., No. 494), the British Standards Institution has now issued the following further Specifications: hot finished weldless steel boiler and superheater tubes for designed steam temperatures not exceeding 850 deg. F. (B.S.S. No. 512); lapwelded wrought-iron boiler tubes for external pressure (B.S.S., No. 527); and lapwelded steel boiler tubes for external pressure (B.S.S., No. 528). These Specifications complete the general series for boiler and superheater tubes which have been prepared as part of the work undertaken two years ago in connection with land boilers. The specification for hot finished weldless steel tubes provides for tubes for designed steam temperatures up to 750 deg. F., and for temperatures between that and 850 deg. F. For the latter range an additional requirement is included that the steel used in the manufacture of the tubes shall be of the non-segregated or fully killed type. The Specifications for lap welded tubes are for external pressure only.

We are informed that the Land Boilers Technical Committee is now turning its attention to the preparation of Specifications for fittings, and a draft is in the course of preparation for safety valves. Copies of these Specifications can be obtained from the British Standards Institution, 28, Victoria Street, S.W.1 (price 2s. 2d. each, post free).

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Arbroath.—Extension to Public Health Hospital; T. H. Hogg, burgh surveyor, Gravesend.

Ashby-de-la-Zouch.—Houses, Measham, Oakthorpe, and Donisthorpe (£19,491); R.D.C. surveyor.

Barking.—Town hall, for Special Corporation Committee.

Barrhead.—Houses (400); A. W. Bryson, Municipal Buildings.

Birmingham.—Shops, Hagley Road West, Quinton, with electrical work; A. Smith, builders, 4, Oughton Road, Camp Hill.

Bishop's Stortford.—Houses (56); U.D.C. surveyor.

Blackpool.—Technical college (£60,000), for Borough E.C.; director of education.

Bournemouth.—School, Kinson, and extensions, Stourfield and East Howe schools, for Borough E.C.; director of education.

Bradford.—Houses (384), High Bedlam, near Tong Street, for M. Hawes, Greystones, Lund Lane, Hampsthwaite; Pullan & Ronchetti, architects, Goodrick's Chambers, Cambridge Street, Harrogate.

Brighton.—Three blocks of flats, Woburn Place; borough engineer. Grand stand, race-course (£13,591); F. T. Wilson & Sons. Corn exchange extensions (£28,038); Hawkins & Co., builders, Norwood Road, London, S.E.

Bucknall (STAFFS).—Houses (20), Longton Road; A. Lilley.

Bursiem.—Alterations and additions to mills, Bridge Street; Middleport Mills Co., Ltd.

Chailey (SUSSEX).—Houses (48); R.D.C. surveyor.

Clackmannanshire.—Primary school, Alloa Park (£19,000), for County E.C.

Coventry.—Block of shops and showrooms, Cross Cheaping (£6,000), with electrical work; Chas. B. Price, builder, Bishopsgate, London, E.C.2.

Cumberland.—Central school, Brampton, for County E.C.; county architect, Carlisle.

Derby.—Houses (85); C. H. Aslin, borough architect, Gower Street.

Dudley.—Block of shops, New Street; Chas. Coulson, builders. Six shops, Priory Estate, with electrical work; Cooper & Sons, builders, West Street, Blackheath, Staffs. Four shops with living accommodation, Union Street (£4,000), with electrical work; H. Smith (Birmingham), Ltd., builders, Erdington, Birmingham.

Dundee.—Bus station and garage, North Lindsay Street (£10,000); Offices, 473, Cathedral Street, Glasgow.

Dundonald.—Houses (33) (£7,700); G. Sandilands, Education Offices, Kirkcaldy.

Dunstable.—Houses (32), Dale Road; A. Boutwood.

East Sussex.—Boys' secondary school, Hove, and extensions to secondary schools, Bexhill-on-Sea and Lewes; director of education, Lewes.

Eccles.—Houses (30) and municipal offices; borough engineer. Market hall, Church Street; Fearnley & Sons, Ltd.

Edinburgh.—Houses (260), for Mactaggart & Mickel, Ltd., 65, Bath Street, Glasgow; Stewart Kaye, architect, 14, Hill Street.

Enfield.—Houses (28), Clay Hill; W. B. Ibbotson.

Epsom.—R.C. school (280 places); priest-in-charge.

Essex.—Library, Chingford, for County E.C.; J. Stuart, county architect, Chelmsford.

Fenton (STAFFS).—Garage accommodation; Potteries Motor Traction Co.

Fifeshire.—High school, Dunfermline, for C.C. (£85,000); G. Sandilands Education Offices, Kirkcaldy.

Flint.—Houses (120), Northop and Coed Onn Road, with electrical installations; T. B. Gorst & Sons, builders, Min-y-don, Colwyn Bay.

Glasgow.—Church, Edinburgh Road, for Dennistoun U.F. Church (continuing); Duncan Crawford, manager for office-bearers, 325, Cumbernauld Road.

Glossop.—Houses (30); borough engineer.

Gosforth (NORTHUMBERLAND).—Houses (20), Dene View; W. Spetch, builder, 17, Rectory Drive.

Haddington.—Houses (100), Annisfield Road; W. L. Hogg, burgh surveyor, Fire Station.

Hanley.—Works extensions, York Street; Howells (Electric Motors), Ltd.

Harrow Weald.—School, Priestmead Road (£14,310); W. S. Try, Uxbridge.

High Wycombe.—Factory extensions, Bellfield, for Harrison & Sons. Shops and flats, Bridge Street, for B. H. Picton.

Huddersfield.—Extensions, including new ward block, maternity home (electrical work); borough engineer.

Ilford.—Houses (177), Baron Gardens, &c.; J. Winkle. Houses (2,000), near Woodford Avenue, Redbridge; Clayhall Estate Co. Houses (120), Saltash Road, &c., and factory, Forest Road; G. E. Seigerts. Ten shops and houses, Somerville Road; Padnall Estates, Ltd.

Irlam (LANCS).—Houses (120) and shops, Silver Street, for J. H. Sharp, St. Annes-on-Sea.

Irvine.—Houses (52), Bank Street; W. L. Weir, burgh surveyor, Town House.

Jarrow-on-Tyne.—Houses (50) for the aged; borough engineer.

Kidderminster.—Factory, Bull Ring; B. French, electrical engineers, Mill Street. Shops, New Street, with electrical work; Lacy Bros., builders, Adam Street.

Kingston-on-Thames.—Re-erection of printing works, London Road, for Kingston and Staines Press, Ltd. Rebuilding business premises, Clarence Street, for Bentalls, Ltd.

Kirkintilloch.—Houses (516); James Coates, burgh surveyor, Council Chambers.

Lancashire.—Senior schools, Formby, for County E.C.; director of education, Preston.

London.—(BATTERSEA).—Tenements, Darien Road (£5,989); borough engineer. (FINCHLEY).—Five shops Woodhouse Road; Lawes & Son, Ltd. (FULHAM).—Clearance, Lillie Yard; borough engineer. (HACKNEY).—Tenements (160), Banister Street (£93,345); borough engineer. Reconstruction of factory, Morning Lane; Lewis Berger & Sons, Ltd. (HAMPSTEAD).—Flats (24), Lyttleton Road; G. Payne. Shops and flats, Falloden Way; Kentish & Sons. (MILL HILL).—Shops, Goodwin Avenue; Hillier, Parker, May & Rowden. (POPLAR).—Flats, High Street; Wilkins, Hatchett & Litt, Chartridge Lane, Chesham. (ST. MARYLEBONE).—Tenements, Lilestone Estate (£12,400); Spiers, Ltd. (ST. PANCRAS).—Creche and flats, Cumberland Market; Crown Lane Commissioners. Rebuilding premises, William Street, for Oetzmann & Co., Ltd.; W. H. White & Sons, architects. (TOTTENHAM).—Stores High Road; London Co-operative Society. (WESTMINSTER).—Houses, Upper Brook Street, Shepherd Street and Lees Place; Masters, Deane & Braddell. Flats, Page Street and Marsham Street; Aston Webb & Son. Block of flats, Petty France and Vandon Street; R. H. J. Minty. (WOOD GREEN).—Library extension and hall; borough engineer.

Macclesfield.—Houses (22), Brough Street, West Macclesfield, with electrical installations; W. Brough & Sons, builders, Park Grove, Macclesfield.

Maesteg.—Houses (26), Park Housing site; E. Davies, surveyor, Council Offices.

Manchester.—Shopping centre, Talbot Road, at the corner of Nag's Head, Davyhulme; James F. Moore, Ltd., builders, Chadwick Road, Eccles.

Margate.—Infant welfare centre; W. R. H. Gardner, architect, Grosvenor Place.

Middlesex.—Extensions, Redhill Hospital, Edgware, and Fryent School, Kingsbury; county architect.

Morecambe.—Houses (16), Charles Street; Brook & Kershaw. Estate development, near Broadway; Harrison & Moore.

Motherwell.—Houses (22) (£12,600); Scott & Co., builders, 116, Hanover Street, Edinburgh.

Normanton (YORKS).—Reconstruction of Empire Theatre; Pennington, Hustler & Taylor, architects, Pontefract.

Northampton.—Houses (30), Birchfield Road; A. Glenn & Sons, Ltd. Houses (96), Council estates, and library, Far Cotton (£3,000); borough engineer.

Northumberland.—School at Forest Hall for County E.C.; W. W. Tasker, county architect, Claremond Place, Newcastle-on-Tyne.

Patcham (SUSSEX).—Houses (450), Ladies Mile Estate; Ladies Mile Estate Co., Ltd. Hall and classroom, Hollingbury Court School, Ditchling Road; O. Morgan.

Penicuik.—School (£31,065) for Borough E.C.; James A. Brown, Municipal Buildings.

Pocklington.—Houses (56); R.D.C. surveyor.

Ponders End.—Factory, Lincoln Road; L. G. Ekins.

Preston.—Factory, Grimsargh, Ribbleton, for Courtaulds, Ltd.

Prestonpans.—Houses (50), Mid Road; F. W. Hardie Co., Ltd., County Buildings, Haddington.

Purley.—Factory, Purley Way; Croydon Factory Estate, Ltd.

Raunds (NORTHANTS).—Houses (84); U.D.C. surveyor.

Rawtenstall.—Baths and public offices; Special Committee.

Richmond (SURREY).—Banking premises, George Street, Barclay's Bank, Ltd.

Rutherglen.—Houses (253); Hugh Inglis, 169, Main Street.

St. Helens (LANCS).—Houses (36), Leach Lane, for J. Twist.

St. Leonards-on-Sea.—Catholic church, Upper Church Road, Horrington, for the Catholic Diocesan Finance Board; Wilfred C. Mangan, 18, Guildhall Street, Preston.

Salford.—Re-erection of factory, Greengate, for Joseph Levy & Co.

Saltcoats.—Houses (107); G. Harley, Kylehill.

Saltdean (SUSSEX).—Estate development, Baze Hill Road; Major Cyril Rhodes.

Sanderstead.—Houses (18), Briton Hill Road; Morgan, Baines & Clark.

Slough.—Houses (160), Manor Park Construction Co., Ltd.

Southend-on-Sea.—Houses (122), Leigh Housing Estate; H. M. Nevell, Ltd., Enfield. Cinema, High Street, for a London syndicate; A. E. Abrahams, Shaftesbury Avenue, London, W.

Staines.—Shops, Kingston Road; North, Robin & Wilsdon.

Stamford (LINCS).—Houses (134); borough surveyor.

Stirlingshire.—School for defectives, Bainsford (£25,000), and school, Raploch (£15,586) for County E.C.; A. N. Malcolm, county architect, Stirling.

Stoke-on-Trent.—Mental colony; Martin & Ward, architects, Birmingham.

Surrey.—School, Mitcham (£33,605) for County E.C.; secretary, Kingston-on-Thames.

Sutton (SURREY).—Baptist church, Cheam Road; Pitchers & Holloway, builders.

Trowbridge.—Houses (300); U.D.C. surveyor.

Tunstall.—Houses (12), High Street, Goldenhill; G. H. Wignall.

Upton (CHESTER).—Houses (149), Long Lane, for Chester Estates, Ltd.

Waddon.—Factory, Waddon Factory Estate; T. G. Crump.

Warwickshire.—School, Sharmans Cross, Solihull, for County E.C.; A. C. Bunch, architect, Shire Hall.

Watford.—Development of Russells Estate and conversion of residence into residential hotel; Arthur H. Holmes, Finsbury House, Blomfield Street, London, E.C.

Wellington (SALOP).—Houses (50), Slang Lane Estate; U.D.C. surveyor.

West Riding.—Mental deficiency colony, Oulton Hall (£753,092) for C.C.; clerk, Wakefield.

Worcester.—Garage and offices, Ombersley Road, with electrical work; Spicers (Builders), Ltd., builders, Penbury Street.

Worcestershire.—School (400 places), Lapal, Halesowen, for County E.C.; director of education, Worcester.

Yeovil.—Creamery for Aplin & Barrett and the Western Counties Creameries, Ltd.; W. H. Skinner, architect.